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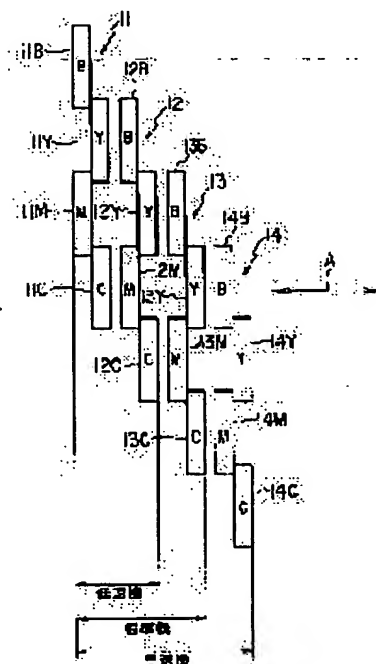
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(54) COLOR INK JET HEAD

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce the cost by realizing a high speed machine, a standard machine, a low speed machine, a high resolution machine, a low resolution machine, and the like, easily using a plurality of head blocks of identical arrangement.

SOLUTION: Head units 11B, 11Y, 11M and 11C of different ink color having identical length, number of nozzles and nozzle pitch are arranged in a direction orthogonal to the print direction thus constituting one head block 11. Four head blocks (11-14) are arranged while being shifted by a length substantially corresponding to the length of the head unit in the direction orthogonal to the print direction such that the nozzles of a head unit second from the end and the nozzles of a head unit at the end are arranged in a row between adjacent head blocks thus constituting a color ink jet head.



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CLAIMS

[Claim(s)]

[Claim 1] As opposed to the number of nozzles of the whole in the color of each ink One of them n (however n use the beef fat unit which prepared the nozzle of the two or more number of integer) in the same pitch. The color ink-jet head characterized by having arranged in the n directions which the color composition of ink is changed per head unit, constitute the head block of one color number ***** at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color, and print this head block.

[Claim 2] Each head block is a color ink-jet head according to claim 1 characterized by having arranged each head unit so that the pitch between the nozzles of the edge where an adjoining head unit adjoins may become the same as that of the nozzle pitch of a head unit.

[Claim 3] Arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same. Length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit in the direction which prints each aforementioned head block, and the direction which intersects perpendicularly. And the color ink-jet head according to claim 2 characterized by having arranged so that it may stand in a line in the direction which the nozzle of the 2nd head unit and the nozzle of the head unit of an edge print from an edge between adjoining head blocks at a single tier.

[Claim 4] The color ink-jet head according to claim 2 to which arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same, and the nozzle of a head unit is characterized by having arranged each aforementioned head block as only 1/[of a nozzle pitch] n shifted mutually.

[Claim 5] The color ink-jet head according to claim 2 characterized by making it the same color not lap in the direction which prints arrangement of the head unit corresponding to the color composition of each ink in each head block mutually while having arranged so that the nozzle of each head unit may be located in a line in the direction which prints each head block at a single tier.

[Claim 6] Each head block is a color ink-jet head according to claim 1 characterized by having arranged each head unit so that the pitch between the nozzles of the edge where an adjoining head unit adjoins may become the integral multiple of the nozzle pitch of a head unit.

[Claim 7] Arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same. Length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit in the direction which prints each aforementioned head block, and the direction which intersects perpendicularly, and In between adjoining head blocks So that the pitch of the other end nozzle of the head unit of the edge in one head block and the end nozzle of the head unit of the edge in the head block of another side may become the same as that of the nozzle pitch of a head unit The color ink-jet head according to claim 6 characterized by having arranged by carrying out.

[Claim 8] The color ink-jet head according to claim 6 to which arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same, and the nozzle of a head unit is characterized by having arranged each aforementioned head block as only 1/[of a nozzle pitch] n shifted mutually.

[Claim 9] As opposed to the number of nozzles of the whole in the color of each ink One of them n (however n use the beef fat unit which prepared the nozzle of the two or more number of integer) in the same pitch. Change the color composition of ink per head unit, and the head block of one color number ***** of ink is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color. It is the color ink-jet head characterized by arranging in the n directions which print this head block, and for each aforementioned nozzle breathing out two or more small ink drops one by one, and forming one pixel.

[Claim 10] As opposed to the number of nozzles of the whole in the color of each ink One of them n (however n use the beef fat unit which prepared the nozzle of the two or more number of integer) in the same pitch. Change the color composition of ink per head unit, and the head block of one color number ***** of ink is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color. The color ink-jet head characterized by the ability to carry out adjustable [of the size of the ** ink drop which arranges in the n directions which print this head block, and is breathed out from each aforementioned nozzle by the volume control].

[Translation done]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the color ink-jet head used for a printer, a copying machine, facsimile apparatus, a plotter, etc.

[0002]

[Description of the Prior Art] Ink-jet technology is widely used for the color printer from the ease of colorization. It is in the inclination which the number of the nozzles which make an ink drop breathe out increases from the demand of high-resolutionizing of printed matter, and improvement in the speed of a print speed in recent years. For this reason, although the large-sized ink-jet head which has very many nozzles is developed, since the yield is bad and serves as cost quantity, one technology which carries out ink-jet head composition is also developed, combining the head unit of the few number of nozzles two or more. It is because this gentleman becomes advantageous in cost. For example, one big head block can be constituted combining the head unit of the few number of nozzles two or more, a color ink-jet head can be constituted from arranging only the number of the colors of the ink which uses this head block, and a function equivalent to the color ink-jet head on which only the number of colors has arranged the large-sized head can be achieved.

[0003] By the way, with a low-speed machine, although there may be few nozzles of the whole head, in order to realize a high-speed machine, it is necessary to make [many] the number of pixels which increases the number of nozzles of the whole head and can be printed at once, when it constitutes a low-speed machine, a standard machine, and a high-speed machine using a color ink-jet head.

[0004] In the former, when realizing the low-speed machine of a color ink jet printer, a standard machine, and a high-speed machine, as shown in (a) of drawing 14, (b), and (c) As shown in the thing which changes the length of a head with a low-speed machine, a standard machine, and a high-speed machine and (a) of drawing 15, (b), and (c), what uses the number of the head units arranged with a low-speed machine, a standard machine, and a high-speed machine, i.e., the head block from which length differs, is known. In addition, as for the inside B of drawing, the head unit which uses black ink is shown, Y shows the head unit which uses yellow ink, M shows the head unit which uses Magenta ink, and C shows the head unit which uses cyano ink.

[0005]

[Problem(s) to be Solved by the Invention] However, since the length of the head used with a low-speed machine, a standard machine, and a high-speed machine differed, what is shown in drawing 14 had to manufacture the head of exclusive use with the low-speed machine, the standard machine, and the high-speed machine, respectively, and had the problem from which economical efficiency serves as cost quantity bad. Moreover, the head block from which length differs with a low-speed machine, a standard machine, and a high-speed machine also in what is shown in drawing 15, respectively had to be prepared, namely, the head block of exclusive use had to be manufactured, respectively, and there was a problem from which economical efficiency serves as cost quantity bad too.

[0006] This did not ask a low-speed machine, a standard machine, and a high-speed machine, but it increased the number of heads to be used to double precision, even when it locates the nozzle of the head of another side between the nozzle pitches of one head and makes resolution double precision, it will increase the head and head block of exclusive use with a low-speed machine, a standard machine, and a high-speed machine, respectively, and it had the problem from which economical efficiency serves as cost quantity bad too. Then, this invention can realize easily a high-speed machine and standard machine, a low-speed machine, a high resolution machine, a low resolution machine, etc., using the head block of the same composition two or more, and offers the color ink-jet head which is excellent in economical efficiency and can fully reduce cost.

[0007]

[Means for Solving the Problem] As opposed to the number of nozzles of the whole [in / the color of each ink / in invention according to claim 1] The head unit which prepared the nozzle of the number of the 1/n (however, n two or more integers) in the same pitch is used. The color composition of ink is changed per head unit, the head block of one color number ***** is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color, and it is in the color ink-jet head arranged in the directions which print this head block.

[0008] Invention according to claim 2 has each head block in having arranged each head unit so that the pitch between the nozzles of the edge where an adjoining head unit adjoins may become the same as that of the nozzle pitch of a head unit in a color ink-jet head according to claim 1.

[0009] Invention according to claim 3 is set on a color ink-jet head according to claim 2. Arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same. Length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit in the direction which prints each head block, and the direction which intersects perpendicularly. And it is in having arranged so that it may stand in a line in the direction which the nozzle of the 2nd head unit and the nozzle of the head unit of an edge print from an edge between adjoining head blocks at a single tier.

[0010] In a color ink-jet head according to claim 2, invention according to claim 4 makes the same arrangement of the head unit corresponding to the color composition of each ink in each head block, and the nozzle of a head unit is mutually about each head block to have arranged, as only $1/n$ [of a nozzle pitch] shifted.

[0011] In a color ink-jet head according to claim 2, invention according to claim 5 is to have made it the same color not lap in the direction which prints arrangement of the head unit corresponding to the color composition of each ink in each head block mutually while arranging it so that the nozzle of each head unit may be located in a line in the direction which prints each head block at a single tier.

[0012] Invention according to claim 6 has each head block in having arranged each head unit so that the pitch between the nozzles of the edge where an adjoining head unit adjoins may become the integral multiple of the nozzle pitch of a head unit in a color ink-jet head according to claim 1.

[0013] Invention according to claim 7 is set on a color ink-jet head according to claim 6. Arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same. Length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit in the direction which prints each head block, and the direction which intersects perpendicularly. And it is in having arranged in between adjoining head blocks, as the pitch of the other end nozzle of the head unit of the edge in one head block and the end nozzle of the head unit of the edge in the head block of another side became the same as that of the nozzle pitch of a head unit.

[0014] In a color ink-jet head according to claim 6, invention according to claim 8 makes the same arrangement of the head unit corresponding to the color composition of each ink in each head block, and the nozzle of a head unit is mutually about each head block to have arranged, as only $1/n$ [of a nozzle pitch] shifted.

[0015] As opposed to the number of nozzles of the whole [in / the color of each ink / in invention according to claim 9] The beef fat unit which prepared the nozzle of the number of the $1/n$ (however, n two or more integers) in the same pitch is used. Change the color composition of ink per head unit, and the head block of one color number ***** of ink is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color. It arranges in the n directions which print this head block, and each nozzle is in the color ink-jet head which carries out the regurgitation of two or more small ink drops one by one, and forms one pixel.

[0016] As opposed to the number of nozzles of the whole [in / the color of each ink / in invention according to claim 10] The beef fat unit which prepared the nozzle of the number of the $1/n$ (however, n two or more integers) in the same pitch is used. Change the color composition of ink per head unit, and the head block of one color number ***** of ink is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color. It arranges in the n directions which print this head block, and is in the color ink-jet head which can carry out adjustable [of the size of the ink drop which carries out the regurgitation from each nozzle by the volume control].

[0017]

[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

(Gestalt of the 1st operation) Drawing 1 is the perspective diagram having shown the important section composition of the printing section, and 1 is a color ink-jet head which constitutes the invention in this application. This color ink-jet head 1 is formed in two parallel slide shafts 2 and 3 free [sliding]. That is, it moves to right and left and the aforementioned color ink-jet head 1 is printed, as the arrow A in drawing shows with each slide shafts 2 and 3. 4 is record media, such as the recording paper, and this record medium 4 is conveyed downward, as the arrow B in drawing shows with the conveyance rollers 5 and 6.

[0018] When it prints, goes and comes back to the aforementioned color ink-jet head 1 one time to the aforementioned record medium 4, moving to right and left in accordance with each slide shafts 2 and 3, only a predetermined distance is conveyed, and again, the aforementioned record medium 4 will print in the position which the color ink-jet head 1 moved to right and left, and followed the last printing portion, and will print a request to a record medium 4 by repeating this.

[0019] Drawing 2 is drawing having shown roughly the composition of the aforementioned color ink-jet head 1, and this head 1 constitutes one head block using four head units from which the same length, the same number of nozzles, and the ink color that consists of the same nozzle pitch differ, and arranges and constitutes these four head blocks.

[0020] That is, head unit 11C which uses head unit 11M which uses head unit 11B which uses black ink, head unit 11Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (direction shown by the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 11 is constituted.

[0021] Moreover, head unit 12C which uses head unit 12M which uses head unit 12B which uses black ink, head unit 12Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction

which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 12 is constituted.

[0022] Moreover, head unit 13C which uses head unit 13M which uses head unit 13B which uses black ink, head unit 13Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 3rd head block 13 is constituted.

[0023] Moreover, head unit 14C which uses head unit 14M which uses head unit 14B which uses black ink, head unit 14Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 4th head block 14 is constituted.

[0024] Each aforementioned head blocks 11, 12, 13, and 14 As shown in (a) of drawing 3 While arranging the head units 11B-14B which use black ink for one block base 15 side, and the head units 11M-14M which use Magenta ink The head units 11Y-14Y which use yellow ink for another side side, and the head units 11C-14C which use cyano ink are arranged. And it is made for each [these] head unit to be located in a line in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen).

[0025] And as the portion of X1 surrounded with a circle [of drawing 3 / of (a)] is expanded and shown in (b) of drawing 3 So that the pitch of the nozzle 16 of the other end of the head units 11B-14B which use black ink, and the nozzle 17 of the end of the head units 11Y-14Y which use yellow ink may become equal to each head units 11B-14B and the nozzle pitch P in 11Y-14Y As the other end of the head units 11B-14B and the end section of the head units 11Y-14Y lapped a little, they arrange.

[0026] This is the same also about the relation between the nozzle of the other end of the head units 11Y-14Y which use yellow ink, the nozzle of the end of the head units 11M-14M which use Magenta ink, and the nozzle of the other end of the head units 11M-14M which use Magenta ink and the nozzle of the end of the head units 11C-14C which use cyano ink.

[0027] And it arranges so that it may stand in a line in the direction in which the nozzle of the 2nd head unit and the nozzle of the head unit of an edge print each aforementioned head blocks 11-14 from an edge in the printing direction and the direction which intersects perpendicularly between length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit, and an adjoining head block at a single tier.

[0028] That is, as shown in drawing 4, it arranges so that it may stand in a line in the direction which the nozzle 18 of head unit 11Y which uses the yellow ink which is the 2nd head unit from the edge of the 1st head block 11 of the above, and the nozzle 19 of head unit 12B which uses the black ink which is the head unit of the edge of the 2nd head block 12 of the above print at a single tier.

[0029] moreover, similarly The nozzle of head unit 12Y which uses the yellow ink which is the 2nd head unit from the edge of the 2nd head block 12 of the above, and the nozzle of head unit 13B which uses the black ink which is the head unit of the edge of the 3rd head block 13 of the above It arranges so that it may stand in a line in the direction to print at a single tier. The nozzle of head unit 13Y which uses the yellow ink which is the 2nd head unit from the edge of the 3rd head block 13 of the above, and the nozzle of head unit 14B which uses the black ink which is the head unit of the edge of the 4th head block 14 of the above It arranges so that it may stand in a line in the direction to print at a single tier.

[0030] In addition, what is necessary is just to determine the number of nozzles of each head unit in consideration of the field of a facility, the field of the yield, the fewest number as printer specification, or most numbers as printer specification of 1 for an integer etc.

[0031] If the color ink-jet head 1 of such composition is used, B (black), It is arranged in the direction printed even if separated [, respectively] in the direction which the head unit of each color of Y (yellow), M (Magenta), and C (cyanogen) prints, and the four directions which intersect perpendicularly. And since the whole of each nozzle will be arranged at intervals of Pitch P If the ink regurgitation timing from the nozzle of each head unit is controlled in each color, printing will be performed by the width of face which is equivalent to four abbreviation for a head unit in 1 **** of heads 1 operating, and a high-speed machine can be realized.

[0032] Moreover, since the head block of the same composition is used, one head block is reduced, printing will be performed by three pieces, then the width of face which is equivalent to three abbreviation for a head unit in 1 **** of heads operating in this case, and a standard machine can be realized, for example. Furthermore, one head block will be reduced, printing will be performed by two pieces, then the width of face which is equivalent to two abbreviation for a head unit in 1 **** of heads operating in this case, and a low-speed machine can be realized.

[0033] Thus, since the head of a high-speed machine and standard machine and a low-speed machine can be manufactured only by changing the number of use of a head block with the same composition, it is not necessary to manufacture the head block of exclusive use according to a high-speed machine and standard machine and a low-speed machine, and the color ink-jet head which is excellent in economical efficiency and can fully reduce cost can be realized.

[0034] By the way, the amount of ink which carries out the regurgitation from a nozzle in a color ink-jet head may be changed. For example, since in the case of the large-sized printer which prints a poster etc. printed matter will usually separate and will be seen, even if ink may sink in to a blot and rear face of ink, it prints in many cases by deep concentration. It is better for there to be no blot of ink, since the printer used in office etc. will be seen on the other hand in near, such as a character. moreover — since double-sided printing may be carried out — the ink to the rear face of a form — also sinking in — it is more desirable for there to be nothing

[0035] Thus, although a demand which is completely different in the amount of ink breathed out from a nozzle is performed by the purpose to print and it can also respond with record media, such as a form, the demands for it, it is necessary to change the amount of ink to breathe out into fully coping with it. For this reason, although the head from which for example, the diameter of a nozzle differs for the purpose to be used may be used, in this, it will be said that various kinds of heads from which the diameter of a nozzle differs must be manufactured.

[0036] Then, since it can carry out adjustable [of the amount of ink, Inc. breathed out from the same nozzle for 1 pixel printing] if the head which can perform gradation control is used, it can respond to various kinds of concentration. There is an ink-jet head of the volume-control formula which controls the size of the ink drop which breathes out two or more small ink drops one by one from a nozzle on the ink-jet head which can perform gradation control, forms one pixel (dot), changes an ink-jet head, and the applied voltage and the resistance welding time of the multidrop formula which controls the number of the ink drops breathed out at this time, and carries out gradation expression, controls the pressure of an ink room, and is breathed out from a nozzle itself.

[0037] The color ink-jet head 1 mentioned above can apply all of both this method to each head unit of each head block, and each printer of the high-speed machine which used by this the color ink-jet head in which gradation control is possible, a standard machine, and a low-speed machine can realize it easily.

[0038] (Form of the 2nd operation) As shown in drawing 5, the form of this operation constitutes one head block using four head units which consist of the same length, the same numbers of nozzles, and the same nozzle pitches, arranges these two head blocks and constitutes the color ink-jet head.

[0039] That is, head unit 21C which uses head unit 21M which use head unit 21B which uses black ink, head unit 21Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 21 is constituted.

[0040] Moreover, head unit 22C which uses head unit 22M which use head unit 22B which uses black ink, head unit 22Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 22 is constituted.

[0041] And each aforementioned head blocks 21 and 22 were shifted a little in the printing direction and the direction which intersects perpendicularly, and are arranged in it. That is, as the portion of X2 enclosed with a circle [of drawing 5] is expanded and shown in drawing 6, as the nozzle 23 of head unit 21B which uses the black ink of the 1st head block 21, and the nozzle 24 of head unit 22B which uses the black ink of the 2nd head block 22 shifted, they arrange only one half of the nozzle pitches P in a head unit mutually.

[0042] Therefore, the relation between the nozzle of other head units 21Y, 21M, and 21C of the 1st head block 21 and the nozzle of other head units 22Y, 22M, and 22C of the 2nd head block 22 comes to shift only one half of the nozzle pitches P of a head unit mutually similarly.

[0043] If it does in this way, since the printing pixel by the 2nd head block 22 will be located between the printing pixels by the 1st head block 21, the pitch which can be printed becomes P/2 and printing in the resolution of the double precision of the resolution of a head block is attained. Thus, a high resolution machine can be easily realized by using two head blocks of the same composition. Moreover, if one head block is accepted and used, a low resolution machine is realizable.

[0044] Moreover, such three head blocks are used, and if the pitch between mutual nozzles shifts and arranges each head block only one third of the nozzle pitches P, the pitch which can be printed becomes P/3 and can raise resolution further. Namely, in order to realize the head which is n times the head block whose resolution it carries out and is one n (however, n two or more integers) use about a head block, only the nozzle P pitches 1/n of a head unit shift each head block, and the pitch between mutual nozzles should just arrange it.

[0045] Thus, since the head from which various kinds of resolution, such as a high resolution machine and a low resolution machine, differs only by changing the number of use of a head block with the same composition can be manufactured, the color ink-jet head which is excellent in economical efficiency and can fully reduce cost is realizable.

[0046] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[0047] (Gestalt of the 3rd operation) As shown in drawing 7, the gestalt of this operation constitutes one head block using four head units from which the same length, the same number of nozzles, and the ink color that consists of the same nozzle pitch differ, as the ink color of a head unit does not lap in the printing direction mutually, arranges four of this head block, and constitutes the color ink-jet head.

[0048] That is, head unit 31C which uses head unit 31M which use head unit 31B which uses black ink, head unit 31Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 31 is constituted.

[0049] Moreover, head unit 32C which uses head unit 32M which use head unit 32B which uses black ink, head unit 32Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of C (cyanogen), B (black), Y (yellow), and M (Magenta), and the 2nd head block 32 is constituted.

[0050] Moreover, head unit 33C which uses head unit 33M which use head unit 33B which uses black ink, head unit 33Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction

which intersects perpendicularly in order of M (Magenta), C (cyanogen), B (black), and Y (yellow), and the 3rd head block 33 is constituted.

[0051] Moreover, head unit 34C which uses head unit 34M which uses head unit 34B which uses black ink, head unit 34Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of Y (yellow), M (Magenta), C (cyanogen), and B (black), and the 4th head block 34 is constituted.

[0052] The arrangement relation of each head unit in each aforementioned head blocks 31-34 and the pitch relation of a nozzle are the same as that of the case of drawing 3 mentioned above. And in the printing direction, as each head unit was located in a line, it arranges each aforementioned head blocks 31-34 at the single tier. That is, as the portion of X3 enclosed with a circle [of drawing 7] is expanded and shown in drawing 8, it arranges so that the nozzle 35 of head unit 33M which uses the Magenta ink of the 3rd head block 33, and the nozzle 36 of head unit 34Y which uses the yellow ink of the 4th head block 34 may be located in a line in the printing direction at a single tier. It arranges so that it may stand in a line in the nozzle 35 and the printing direction of head unit 33M in which the nozzle of head unit 32C which uses the nozzle of head unit 31B which uses the black ink of the 1st head block 31 similarly, and the cyano ink of the 2nd head block 32 also uses the Magenta ink of the 3rd head block 33 at a single tier.

[0053] If the color ink-jet head of such composition is used, B (black), It is arranged in the direction printed even if separated [, respectively] in the direction which the head unit of each color of Y (yellow), M (Magenta), and C (cyanogen) prints, and the four directions which intersect perpendicularly. And since the whole of each nozzle will be arranged at intervals of Pitch P If the ink regurgitation timing from the nozzle of each head unit is controlled in each color, printing will be performed by the width of face which is equivalent to four abbreviation for a head unit in 1 **** of heads operating, and a high-speed machine can be realized.

[0054] Moreover, since the head block of the same composition is used, one head block is reduced, printing will be performed by three pieces, then the width of face which is equivalent to three abbreviation for a head unit in 1 **** of heads operating in this case, and a standard machine can be realized, for example. Furthermore, one head block will be reduced, printing will be performed by two pieces, then the width of face which is equivalent to two abbreviation for a head unit in 1 **** of heads operating in this case, and a low-speed machine can be realized.

[0055] Thus, since the head of a high-speed machine and standard machine and a low-speed machine can be manufactured only by changing the number of use of the head block from which only the color array of the ink which composition is the same and uses differs, it is not necessary to manufacture the head block of exclusive use according to a high-speed machine and standard machine and a low-speed machine, and the color ink-jet head which is excellent in economical efficiency and can fully reduce cost can be realized. Moreover, since each head block is put in order and arranged in the printing direction at the single tier, without shifting in the printing direction and the direction which intersects perpendicularly, the length of the whole head is made to the length of an abbreviation head block, and can be shortened.

[0056] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[0057] (Gestalt of the 4th operation) As shown in drawing 9, the gestalt of this operation constitutes one head block using four head units from which the same length, the same number of nozzles, and the ink color that consists of the same nozzle pitch differ, and arranges and constitutes these four head blocks.

[0058] Namely, head unit 41B which uses black ink, head unit 41Y which uses yellow ink, Head unit 41C which uses head unit 41M which uses Magenta ink, and cyano ink A predetermined interval is opened in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 1st head block 41 is constituted.

[0059] Moreover, a predetermined interval is opened in the direction which intersects perpendicularly with the printing direction head unit 42C which uses head unit 42M which uses head unit 42B which uses black ink, head unit 42Y which uses yellow ink, and Magenta ink, and cyano ink, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 42 is constituted.

[0060] Moreover, a predetermined interval is opened in the direction which intersects perpendicularly with the printing direction head unit 43C which uses head unit 43M which uses head unit 43B which uses black ink, head unit 43Y which uses yellow ink, and Magenta ink, and cyano ink, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 3rd head block 43 is constituted.

[0061] Moreover, a predetermined interval is opened in the direction which intersects perpendicularly with the printing direction head unit 44C which uses head unit 44M which uses head unit 44B which uses black ink, head unit 44Y which uses yellow ink, and Magenta ink, and cyano ink, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 4th head block 44 is constituted.

[0062] Each aforementioned head blocks 41, 42, 43, and 44 The head units 41B-44B which use black ink for one block basis side as shown in (a) of drawing 10. The head units 41Y-44Y which use yellow ink, the head units 41M-44M which use Magenta ink, It is made to stand in a line in the direction in which the head units 41C-44C which use cyano ink are arranged, and the printing direction and each [these] head unit cross at right angles in order of B (black), Y (yellow), M (Magenta), and C (cyanogen).

[0063] And as the portion of X4 surrounded with a circle [of drawing 10 / of (a)] is expanded and shown in (b) of drawing 10 the integral multiple of the nozzle pitch [in / each head units 41B-44B, and 41Y-44Y / in the pitch of the nozzle 46 of the other end of the head units 41B-44B which use black ink, and the nozzle 47 of the end of the

head units 41Y-44Y which use yellow ink] P — that is The other end of the head units 41B-44B and the end section of the head units 41Y-44Y open and arrange the predetermined interval so that it may become m times. [0064] This is the same also about the relation between the nozzle of the other end of the head units 41Y-44Y which use yellow ink, the nozzle of the end of the head units 41M-44M which use Magenta ink, and the nozzle of the other end of the head units 41M-44M which use Magenta ink and the nozzle of the end of the head units 41C-44C which use cyano ink.

[0065] very [and / the length shorter than the length of a head unit in the direction which intersects perpendicularly each aforementioned head blocks 41-44 with the printing direction] — it shifted one by one and arranges As shown in drawing 11 , for example, between the nozzle 46 of the other end of head unit 41B which uses the black ink which is the head unit of the other end of the 1st head block 41 of the above, and the nozzle 47 of the end of head unit 41Y which uses the following yellow ink Two nozzles 48 by the side of the end of head unit 42B which uses the black ink which is the head unit of the other end of the 2nd head block 42 of the above enter exactly. And as the pitch of a nozzle 46, a nozzle 48 and a nozzle 48, and a nozzle 47 was in agreement with the nozzle pitch P of a head unit exactly, it arranges the 2nd head block 42.

[0066] This arrangement is the same also about arrangement of the 4th head block 44 to the arrangement of the 3rd head block 43 and the 3rd head block 43 to the 2nd head block 42 of the above.

[0067] If the color ink-jet head 1 of such composition is used, B (black), It is arranged in the direction printed even if separated [, respectively] in the direction which the head unit of each color of Y (yellow), M (Magenta), and C (cyanogen) prints, and the four directions which intersect perpendicularly. And since the whole of each nozzle will be arranged at intervals of Pitch P If the ink regurgitation timing from the nozzle of each head unit is controlled in each color, printing will be performed by the width of face which is equivalent to four abbreviation for a head unit in 1 **** of heads 1 operating, and a high-speed machine can be realized.

[0068] Moreover, since the head block of the same composition is used, one head block is reduced, printing will be performed by three pieces, then the width of face which is equivalent to three abbreviation for a head unit in 1 **** of heads operating in this case, and a standard machine can be realized, for example. Furthermore, one head block will be reduced, printing will be performed by two pieces, then the width of face which is equivalent to two abbreviation for a head unit in 1 **** of heads operating in this case, and a low-speed machine can be realized.

[0069] Thus, since the head of a high-speed machine and standard machine and a low-speed machine can be manufactured only by changing the number of use of a head block with the same composition, it is not necessary to manufacture the head block of exclusive use according to a high-speed machine and standard machine and a low-speed machine, and the color ink-jet head which is excellent in economical efficiency and can fully reduce cost can be realized.

[0070] Moreover, since each head blocks 41-44 arrange the head unit of each color to one block base 45 side, they can narrow width of face of the printing direction, and the width of face of the whole head can also do them narrowly.

[0071] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[0072] (Gestalt of the 5th operation) As shown in drawing 12 , the gestalt of this operation constitutes one head block using four head units which consist of the same length, the same numbers of nozzles, and the same nozzle pitches, arranges these two head blocks and constitutes the color ink-jet head.

[0073] That is, head unit 51C which uses head unit 51M which use head unit 51B which uses black ink, head unit 51Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 51 is constituted.

[0074] Moreover, head unit 52C which uses head unit 52M which use head unit 52B which uses black ink, head unit 52Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 52 is constituted.

[0075] And each aforementioned head blocks 51 and 52 were shifted a little in the printing direction and the direction which intersects perpendicularly, and are arranged in it. That is, as the portion of X5 enclosed with with a circle [of drawing 12] is expanded and shown in drawing 13 , as the nozzle 53 of head unit 51B which uses the black ink of the 1st head block 51, and the nozzle 54 of head unit 52B which uses the black ink of the 2nd head block 52 shifted, they arrange only one half of the nozzle pitches P in a head unit mutually.

[0076] Therefore, the relation between the nozzle of other head units 51Y, 51M, and 51C of the 1st head block 51 and the nozzle of other head units 52Y, 52M, and 52C of the 2nd head block 52 comes to shift only one half of the nozzle pitches P of a head unit mutually similarly.

[0077] If it does in this way, since the printing pixel by the 2nd head block 52 will be located between the printing pixels by the 1st head block 51, the pitch which can be printed becomes $P/2$ and printing in the resolution of the double precision of the resolution of a head block is attained. Thus, a high resolution machine can be easily realized by using two head blocks of the same composition. Moreover, if one head block is accepted and used, a low resolution machine is realizable.

[0078] Moreover, such three head blocks are used, and if the pitch between mutual nozzles shifts and arranges each head block only one third of the nozzle pitches P, the pitch which can be printed becomes $P/3$ and can raise resolution further. Namely, in order to realize the head which is n times the head block whose resolution it carries

ut and is one n (however, n two or more integers) us about a head block, only the nozzle P pitches $1/n$ of a head unit shift each head block, and the pitch between mutual nozzles should just arrange it.

[0079] Thus, since the head from which various kinds of resolution, such as a high resolution machine and a low resolution machine, differs only by changing the number of us of a head block with the same composition can be manufactured, the color ink-jet head which is excellent in economical efficiency and can fully reduce cost is realizable.

[0080] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[0081]

[Effect of the Invention] According to invention given [each] in a claim, a high-speed machine and standard machine, a low-speed machine, a high resolution machine, a low resolution machine, etc. can be realized easily, using the head block of the same composition two or more, it excels in economical efficiency, and cost can fully be reduced.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the color ink-jet head used for a printer, a copying machine, facsimile apparatus, a plotter, etc.

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PRIOR ART

[Description of the Prior Art] Ink-jet technology is widely used for the color printer from the ease of colorization. It is in the inclination which the number of the nozzles which make an ink drop breathe out increases from the demand of high-resolution-izing of printed matter, and improvement in the speed of a print speed in recent years. For this reason, although the large-sized ink-jet head which has very many nozzles is developed, since the yield is bad and serves as cost quantity, one technology which carries out ink-jet head composition is also developed, combining the head unit of the few number of nozzles two or more. It is because this gentleman becomes advantageous in cost. For example, one big head block can be constituted combining the head unit of the few number of nozzles two or more, a color ink-jet head can be constituted from arranging only the number of the colors of the ink which uses this head block, and a function equivalent to the color ink-jet head on which only the number of colors has arranged. the large-sized head can be achieved.

[0003] By the way, with a low-speed machine, although there may be few nozzles of the whole head, in order to realize a high-speed machine, it is necessary to make [many] the number of pixels which increases the number of nozzles of the whole head and can be printed at once, when it constitutes a low-speed machine, a standard machine, and a high-speed machine using a color ink-jet head.

[0004] In the former, when realizing the low-speed machine of a color ink jet printer, a standard machine, and a high-speed machine, as shown in (a) of drawing 14 , (b), and (c) As shown in the thing which changes the length of a head with a low-speed machine, a standard machine, and a high-speed machine and (a) of drawing 15 , (b), and (c), what uses the number of the head units arranged with a low-speed machine, a standard machine, and a high-speed machine, i.e., the head block from which length differs, is known. In addition, as for the inside B of drawing, the head unit which uses black ink is shown, Y shows the head unit which uses yellow ink, M shows the head unit which uses Magenta ink, and C shows the head unit which uses cyano ink.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to invention given [each] in a claim, a high-speed machine and standard machine, a low-speed machine, a high resolution machine, a low resolution machine, etc. can be realized easily, using the head block of the same composition two or more, it excels in economical efficiency, and cost can fully be reduced.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, since the length of the head used with a low-speed machine, a standard machine, and a high-speed machine differed, what is shown in drawing 14 had to manufacture the head of exclusive use with the low-speed machine, the standard machine, and the high-speed machine, respectively, and had the problem from which economical efficiency serves as cost quantity bad. Moreover, the head block from which length differs with a low-speed machine, a standard machine, and a high-speed machine also in what is shown in drawing 15, respectively had to be prepared, namely, the head block of exclusive use had to be manufactured, respectively, and there was a problem from which economical efficiency serves as cost quantity bad too. [0006] This did not ask a low-speed machine, a standard machine, and a high-speed machine, but it increased the number of heads to be used to double precision, even when it locates the nozzle of the head of another side between the nozzle pitches of one head and makes resolution double precision, it will increase the head and head block of exclusive use with a low-speed machine, a standard machine, and a high-speed machine, respectively, and it had the problem from which economical efficiency serves as cost quantity bad too. Then, this invention can realize easily a high-speed machine and standard machine, a low-speed machine, a high resolution machine, a low resolution machine, etc., using the head block of the same composition two or more, and offers the color ink-jet head which is excellent in economical efficiency and can fully reduce cost.

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MEANS

[Means for Solving the Problem] As opposed to the number of nozzles of the whole [in / the color of each ink / in invention according to claim 1] The beef fat unit which prepared the nozzle of the number of the $1/n$ (however, n two or more integers) in the same pitch is used. The color composition of ink is changed per head unit, the head block of one color number ***** is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color, and it is in the color ink-jet head arranged in the n directions which print this head block.

[0008] Invention according to claim 2 has each head block in having arranged each head unit so that the pitch between the nozzles of the edge where an adjoining head unit adjoins may become the same as that of the nozzle pitch of a head unit in a color ink-jet head according to claim 1.

[0009] Invention according to claim 3 is set on a color ink-jet head according to claim 2. Arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same. Length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit in the direction which prints each head block, and the direction which intersects perpendicularly, And it is in having arranged so that it may stand in a line in the direction which the nozzle of the 2nd head unit and the nozzle of the head unit of an edge print from an edge between adjoining head blocks at a single tier.

[0010] In a color ink-jet head according to claim 2, invention according to claim 4 makes the same arrangement of the head unit corresponding to the color composition of each ink in each head block, and the nozzle of a head unit is mutually about each head block to have arranged, as only $1/[\text{of a nozzle pitch}] n$ shifted.

[0011] In a color ink-jet head according to claim 2, invention according to claim 5 is to have made it the same color not lap in the direction which prints arrangement of the head unit corresponding to the color composition of each ink in each head block mutually while arranging it so that the nozzle of each head unit may be located in a line in the direction which prints each head block at a single tier.

[0012] Invention according to claim 6 has each head block in having arranged each head unit so that the pitch between the nozzles of the edge where an adjoining head unit adjoins may become the integral multiple of the nozzle pitch of a head unit in a color ink-jet head according to claim 1.

[0013] Invention according to claim 7 is set on a color ink-jet head according to claim 6. Arrangement of the head unit corresponding to the color composition of each ink in each head block is made the same. Length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit in the direction which prints each head block, and the direction which intersects perpendicularly, And it is in having arranged in between adjoining head blocks, as the pitch of the other end nozzle of the head unit of the edge in one head block and the end nozzle of the head unit of the edge in the head block of another side became the same as that of the nozzle pitch of a head unit.

[0014] In a color ink-jet head according to claim 6, invention according to claim 8 makes the same arrangement of the head unit corresponding to the color composition of each ink in each head block, and the nozzle of a head unit is mutually about each head block to have arranged, as only $1/[\text{of a nozzle pitch}] n$ shifted.

[0015] As opposed to the number of nozzles of the whole [in / the color of each ink / in invention according to claim 9] The beef fat unit which prepared the nozzle of the number of the $1/n$ (however, n two or more integers) in the same pitch is used. Change the color composition of ink per head unit, and the head block of one color number ***** of ink is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color. It arranges in the n directions which print this head block, and each nozzle is in the color ink-jet head which breathes out two or more small ink drops one by one, and forms one pixel.

[0016] As opposed to the number of nozzles of the whole [in / the color of each ink / in invention according to claim 10] The beef fat unit which prepared the nozzle of the number of the $1/n$ (however, n two or more integers) in the same pitch is used. Change the color composition of ink per head unit, and the head block of one color number ***** of ink is constituted at least in the direction which intersects perpendicularly with the direction which prints the head unit of each color. It arranges in the n directions which print this head block, and is in the color ink-jet head which can carry out adjustable [of the size of the ink drop which carries out the regurgitation from each nozzle by the volume control].

[0017]

[Embodiments of the Invention] Hereafter, the form of operation of this invention is explained with reference to a drawing.

(Form of the 1st operation) Drawing 1 is the perspective diagram having shown the important section composition of

the printing section, and 1 is a color ink-jet head which constitutes the invention in this application. This color ink-jet head 1 is formed in two parallel slide shafts 2 and 3 free [sliding]. That is, it moves to right and left and the aforementioned color ink-jet head 1 is printed, as the arrow A in drawing shows with each slide shafts 2 and 3. 4 is record media, such as the recording paper, and this record medium 4 is conveyed downward, as the arrow B in drawing shows with the conveying rollers 5 and 6.

[0018] When it prints, goes and comes back to the aforementioned color ink-jet head 1 on time to the aforementioned record medium 4, moving to right and left in accordance with each slide shafts 2 and 3, only a predetermined distance is conveyed, and again, the aforementioned record medium 4 will print in the position which the color ink-jet head 1 moved to right and left, and followed the last printing portion, and will print a request to a record medium 4 by repeating this.

[0019] Drawing 2 is drawing having shown roughly the composition of the aforementioned color ink-jet head 1, and this head 1 constitutes one head block using four head units from which the same length, the same number of nozzles, and the ink color that consists of the same nozzle pitch differ, and arranges and constitutes these four head blocks.

[0020] That is, head unit 11C which uses head unit 11M which uses head unit 11B which uses black ink, head unit 11Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (direction shown by the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 11 is constituted.

[0021] Moreover, head unit 12C which uses head unit 12M which uses head unit 12B which uses black ink, head unit 12Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 12 is constituted.

[0022] Moreover, head unit 13C which uses head unit 13M which uses head unit 13B which uses black ink, head unit 13Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 3rd head block 13 is constituted.

[0023] Moreover, head unit 14C which uses head unit 14M which uses head unit 14B which uses black ink, head unit 14Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 4th head block 14 is constituted.

[0024] Each aforementioned head blocks 11, 12, 13, and 14 As shown in (a) of drawing 3 While arranging the head units 11B-14B which use black ink for one block base 15 side, and the head units 11M-14M which use Magenta ink. The head units 11Y-14Y which use yellow ink for another side side, and the head units 11C-14C which use cyano ink are arranged. And it is made for each [these] head unit to be located in a line in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen).

[0025] And as the portion of X1 surrounded with a circle [of drawing 3 / of (a)] is expanded and shown in (b) of drawing 3 So that the pitch of the nozzle 16 of the other end of the head units 11B-14B which use black ink, and the nozzle 17 of the end of the head units 11Y-14Y which use yellow ink may become equal to each head units 11B-14B and the nozzle pitch P in 11Y-14Y As the other end of the head units 11B-14B and the end section of the head units 11Y-14Y lapped a little, they arrange.

[0026] This is the same also about the relation between the nozzle of the other end of the head units 11Y-14Y which use yellow ink, the nozzle of the end of the head units 11M-14M which use Magenta ink, and the nozzle of the other end of the head units 11M-14M which use Magenta ink and the nozzle of the end of the head units 11C-14C which use cyano ink.

[0027] And it arranges so that it may stand in a line in the direction in which the nozzle of the 2nd head unit and the nozzle of the head unit of an edge print each aforementioned head blocks 11-14 from an edge in the printing direction and the direction which intersects perpendicularly between length [every] sequential staggering which carries out an abbreviation equivalent to the length of a head unit, and an adjoining head block at a single tier.

[0028] That is, as shown in drawing 4, it arranges so that it may stand in a line in the direction which the nozzle 18 of head unit 11Y which uses the yellow ink which is the 2nd head unit from the edge of the 1st head block 11 of the above, and the nozzle 19 of head unit 12B which uses the black ink which is the head unit of the edge of the 2nd head block 12 of the above print at a single tier.

[0029] moreover, similarly The nozzle of head unit 12Y which uses the yellow ink which is the 2nd head unit from the edge of the 2nd head block 12 of the above, and the nozzle of head unit 13B which uses the black ink which is the head unit of the edge of the 3rd head block 13 of the above It arranges so that it may stand in a line in the direction to print at a single tier. The nozzle of head unit 13Y which uses the yellow ink which is the 2nd head unit from the edge of the 3rd head block 13 of the above, and the nozzle of head unit 14B which uses the black ink which is the head unit of the edge of the 4th head block 14 of the above It arranges so that it may stand in a line in the direction to print at a single tier.

[0030] In addition, what is necessary is just to determine the number of nozzles of each head unit in consideration of the field of a facility, the field of the yield, the fewest number as printer specification, or most numbers as printer specification of 1 for an integer.

[0031] If the color ink-jet head 1 of such composition is used, B (black), It is arranged in the direction print even if separately [respectively] in the direction which the head unit of each color of Y (yellow), M (Magenta), and C

(cyanogen) prints, and the four directions which intersect perpendicularly. And since the whole of each nozzle will be arranged at intervals of Pitch P. If the ink **** timing from the nozzle of each head unit is controlled in each color, printing will be performed by the width of face which is equivalent to four abbreviation for a head unit in 1 **** of heads 1 operating, and a high-speed machine can be realized.

[0032] Moreover, since the head block of the same composition is used, one head block is reduced, printing will be performed by three pieces, then the width of face which is equivalent to three abbreviation for a head unit in 1 **** of heads operating in this case, and a standard machine can be realized, for example. Furthermore, one head block will be reduced, printing will be performed by two pieces, then the width of face which is equivalent to two abbreviation for a head unit in 1 **** of heads operating in this case, and a low-speed machine can be realized.

[0033] Thus, since the head of a high-speed machine and standard machine and a low-speed machine can be manufactured only by changing the number of use of a head block with the same composition, it is not necessary to manufacture the head block of exclusive use according to a high-speed machine and standard machine and a low-speed machine, and the color ink-jet head which is excellent in economical efficiency and can fully reduce cost can be realized.

[0034] By the way, the amount of ** ink breathed out from a nozzle in a color ink-jet head may be changed. For example, since in the case of the large-sized printer which prints a poster etc. printed matter will usually separate and will be seen, even if ink may sink in to a blot and rear face of ink, it prints in many cases by deep concentration. It is better for there to be no blot of ink, since the printer used in office etc. will be seen on the other hand in near, such as a character. moreover — since double-sided printing may be carried out — the ink to the rear face of a form — also sinking in — it is more desirable for there to be nothing

[0035] Thus, although a demand which is completely different in the amount of ** ink breathed out from a nozzle is performed by the purpose to print and it can also respond with record media, such as a form, to these demands for it, it is necessary to change the amount of ** ink to breathe out into fully coping with it. For this reason, although the head from which for example, the diameter of a nozzle differs for the purpose to be used may be used, in this, it will be said that various kinds of heads from which the diameter of a nozzle differs must be manufactured.

[0036] Then, since it can carry out adjustable [of the amount of **, Inc. breathed out from the same nozzle for 1 pixel printing] if the head which can perform gradation control is used, it can respond to various kinds of concentration. There is an ink-jet head of the volume-control formula which controls the size of the ** ink drop which breathes out two or more small ink drops one by one from a nozzle on the ink-jet head which can perform gradation control, forms one pixel (dot), changes an ink-jet head, and the applied voltage and the resistance welding time of the multidrop formula which controls the number of the ** ink drops breathed out at this time, and carries out gradation expression, controls the pressure of an ink room, and is breathed out from a nozzle itself.

[0037] The color ink-jet head 1 mentioned above can apply all of both this method to each head unit of each head block, and each printer of the high-speed machine which used by this the color ink-jet head in which gradation control is possible, a standard machine, and a low-speed machine can realize it easily.

[0038] (Form of the 2nd operation) As shown in drawing 5, the form of this operation constitutes one head block using four head units which consist of the same length, the same numbers of nozzles, and the same nozzle pitches, arranges these two head blocks and constitutes the color ink-jet head.

[0039] That is, head unit 21C which uses head unit 21M which uses head unit 21B which uses black ink, head unit 21Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 21 is constituted.

[0040] Moreover, head unit 22C which uses head unit 22M which uses head unit 22B which uses black ink, head unit 22Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 22 is constituted.

[0041] And each aforementioned head blocks 21 and 22 were shifted a little in the printing direction and the direction which intersects perpendicularly, and are arranged in it. That is, as the portion of X2 enclosed with a circle [of drawing 5] is expanded and shown in drawing 6, as the nozzle 23 of head unit 21B which uses the black ink of the 1st head block 21, and the nozzle 24 of head unit 22B which uses the black ink of the 2nd head block 22 shifted, they arrange only one half of the nozzle pitches P in a head unit mutually.

[0042] Therefore, the relation between the nozzle of other head units 21Y, 21M, and 21C of the 1st head block 21 and the nozzle of other head units 22Y, 22M, and 22C of the 2nd head block 22 comes to shift only one half of the nozzle pitches P of a head unit mutually similarly.

[0043] If it does in this way, since the printing pixel by the 2nd head block 22 will be located between the printing pixels by the 1st head block 21, the pitch which can be printed becomes P/2 and printing in the resolution of the double precision of the resolution of a head block is attained. Thus, a high resolution machine can be easily realized by using two head blocks of the same composition. Moreover, if one head block is accepted and used, a low resolution machine is realizable.

[0044] Moreover, such three head blocks are used, and if the pitch between mutual nozzles shifts and arranges each head block only one third of the nozzle pitch P, the pitch which can be printed becomes P/3 and can raise resolution further. Namely, in order to realize the head which is n times the head block whose resolution it carries out and is one n (however, n two or more integers) about a head block, only the nozzle P pitch 1/n of a head unit shift each head block, and the pitch between mutual nozzles should just arrange it.

[0045] Thus, since the head from which various kinds of resolution, such as a high resolution machine and a low resolution machine, differs only by changing the number of use of a head block with the same composition can be manufactured, the color ink-jet head which is excellent in economical efficiency and can fully reduce cost is realizable.

[0046] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[0047] (Form of the 3rd operation) As shown in drawing 7, the form of this operation constitutes one head block using four head units from which the same length, the same number of nozzles, and the ink color that consists of the same nozzle pitch differ, as the ink color of a head unit does not lap in the printing direction mutually, arranges four of this head block, and constitutes the color ink-jet head.

[0048] That is, head unit 31C which uses head unit 31M which use head unit 31B which uses black ink, head unit 31Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 31 is constituted.

[0049] Moreover, head unit 32C which uses head unit 32M which use head unit 32B which uses black ink, head unit 32Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of C (cyanogen), B (black), Y (yellow), and M (Magenta), and the 2nd head block 32 is constituted.

[0050] Moreover, head unit 33C which uses head unit 33M which use head unit 33B which uses black ink, head unit 33Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of M (Magenta), C (cyanogen), B (black), and Y (yellow), and the 3rd head block 33 is constituted.

[0051] Moreover, head unit 34C which uses head unit 34M which use head unit 34B which uses black ink, head unit 34Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in the printing direction and the direction which intersects perpendicularly in order of Y (yellow), M (Magenta), C (cyanogen), and B (black), and the 4th head block 34 is constituted.

[0052] The arrangement relation of each head unit in each aforementioned head blocks 31-34 and the pitch relation of a nozzle are the same as that of the case of drawing 3 mentioned above. And in the printing direction, as each head unit was located in a line, it arranges each aforementioned head blocks 31-34 at the single tier. That is, as the portion of X3 enclosed with a circle [of drawing 7] is expanded and shown in drawing 8, it arranges so that the nozzle 35 of head unit 33M which use the Magenta ink of the 3rd head block 33, and the nozzle 36 of head unit 34Y which uses the yellow ink of the 4th head block 34 may be located in a line in the printing direction at a single tier. It arranges so that it may stand in a line in the nozzle 35 and the printing direction of head unit 33M in which the nozzle of head unit 32C which uses the nozzle of head unit 31B which uses the black ink of the 1st head block 31 similarly, and the cyano ink of the 2nd head block 32 also uses the Magenta ink of the 3rd head block 33 at a single tier.

[0053] If the color ink-jet head of such composition is used, B (black), It is arranged in the direction printed even if separated [, respectively] in the direction which the head unit of each color of Y (yellow), M (Magenta), and C (cyanogen) prints, and the four directions which intersect perpendicularly. And since the whole of each nozzle will be arranged at intervals of Pitch P If the ink **** timing from the nozzle of each head unit is controlled in each color, printing will be performed by the width of face which is equivalent to four abbreviation for a head unit in 1 **** of heads operating, and a high-speed machine can be realized.

[0054] Moreover, since the head block of the same composition is used, one head block is reduced, printing will be performed by three pieces, then the width of face which is equivalent to three abbreviation for a head unit in 1 **** of heads operating in this case, and a standard machine can be realized, for example. Furthermore, one head block will be reduced, printing will be performed by two pieces, then the width of face which is equivalent to two abbreviation for a head unit in 1 **** of heads operating in this case, and a low-speed machine can be realized.

[0055] Thus, since the head of a high-speed machine and standard machine and a low-speed machine can be manufactured only by changing the number of use of the head block from which only the color array of the ink which composition is the same and uses differs, it is not necessary to manufacture the head block of exclusive use according to a high-speed machine and standard machine and a low-speed machine, and the color ink-jet head which is excellent in economical efficiency and can fully reduce cost can be realized. Moreover, since each head block is put in order and arranged in the printing direction at the single tier, without shifting in the printing direction and the direction which intersects perpendicularly, the length of the whole head is made to the length of an abbreviation head block, and can be shortened.

[0056] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[0057] (Form of the 4th operation) As shown in drawing 9, the form of this operation constitutes one head block using four head units from which the same length, the same number of nozzles, and the ink color that consists of the same nozzle pitch differ, and arranges and constitutes these four head blocks.

[0058] Namely, head unit 41B which uses black ink, head unit 41Y which uses yellow ink, Head unit 41C which uses Magenta ink, and cyano ink A predetermined interval is printed in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 1st head block 41 is constituted.

[0059] Moreover, a predetermined interval is opened in the direction which intersects perpendicularly with the printing direction head unit 42C which uses head unit 42M which uses head unit 42B which uses black ink, head unit 42Y which uses yellow ink, and Magenta ink, and cyano ink, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 42 is constituted.

[0060] Moreover, a predetermined interval is opened in the direction which intersects perpendicularly with the printing direction head unit 43C which uses head unit 43M which uses head unit 43B which uses black ink, head unit 43Y which uses yellow ink, and Magenta ink, and cyano ink, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 3rd head block 43 is constituted.

[0061] Moreover, a predetermined interval is opened in the direction which intersects perpendicularly with the printing direction head unit 44C which uses head unit 44M which uses head unit 44B which uses black ink, head unit 44Y which uses yellow ink, and Magenta ink, and cyano ink, it arranges in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 4th head block 44 is constituted.

[0062] Each aforementioned head blocks 41, 42, 43, and 44 The head units 41B-44B which use black ink for one block base 45 side as shown in (a) of drawing 10. The head units 41Y-44Y which use yellow ink, the head units 41M-44M which use Magenta ink, It is made to stand in a line in the direction in which the head units 41C-44C which use cyano ink are arranged, and the printing direction and each [these] head unit cross at right angles in order of B (black), Y (yellow), M (Magenta), and C (cyanogen).

[0063] And as the portion of X4 surrounded with a circle [of drawing 10 / of (a)] is expanded and shown in (b) of drawing 10 the integral multiple of the nozzle pitch [in / each head units 41B-44B, and 41Y-44Y / in the pitch of the nozzle 46 of the other end of the head units 41B-44B which use black ink, and the nozzle 47 of the end of the head units 41Y-44Y which use yellow ink] P — that is The other end of the head units 41B-44B and the end section of the head units 41Y-44Y open and arrange the predetermined interval so that it may become m times.

[0064] This is the same also about the relation between the nozzle of the other end of the head units 41Y-44Y which use yellow ink, the nozzle of the end of the head units 41M-44M which use Magenta ink, and the nozzle of the other end of the head units 41M-44M which use Magenta ink and the nozzle of the end of the head units 41C-44C which use cyano ink.

[0065] every [and / the length shorter than the length of a head unit in the direction which intersects perpendicularly each aforementioned head blocks 41-44 with the printing direction] — it shifted one by one and arranges As shown in drawing 11, for example, between the nozzle 46 of the other end of head unit 41B which uses the black ink which is the head unit of the other end of the 1st head block 41 of the above, and the nozzle 47 of the end of head unit 41Y which uses the following yellow ink Two nozzles 48 by the side of the end of head unit 42B which uses the black ink which is the head unit of the other end of the 2nd head block 42 of the above enter exactly. And as the pitch of a nozzle 46, a nozzle 48 and a nozzle 48, and a nozzle 47 was in agreement with the nozzle pitch P of a head unit exactly, it arranges the 2nd head block 42.

[0066] This arrangement is the same also about arrangement of the 4th head block 44 to the arrangement of the 3rd head block 43 and the 3rd head block 43 to the 2nd head block 42 of the above.

[0067] If the color ink-jet head 1 of such composition is used, B (black), It is arranged in the direction printed even if separated [, respectively] in the direction which the head unit of each color of Y (yellow), M (Magenta), and C (cyanogen) prints, and the four directions which intersect perpendicularly. And since the whole of each nozzle will be arranged at intervals of Pitch P If the ink **** timing from the nozzle of each head unit is controlled in each color, printing will be performed by the width of face which is equivalent to four abbreviation for a head unit in 1 **** of heads 1 operating, and a high-speed machine can be realized.

[0068] Moreover, since the head block of the same composition is used, one head block is reduced, printing will be performed by three pieces, then the width of face which is equivalent to three abbreviation for a head unit in 1 **** of heads operating in this case, and a standard machine can be realized, for example. Furthermore, one head block will be reduced, printing will be performed by two pieces, then the width of face which is equivalent to two abbreviation for a head unit in 1 **** of heads operating in this case, and a low-speed machine can be realized.

[0069] Thus, since the head of a high-speed machine and standard machine and a low-speed machine can be manufactured only by changing the number of use of a head block with the same composition, it is not necessary to manufacture the head block of exclusive use according to a high-speed machine and standard machine and a low-speed machine, and the color ink-jet head which is excellent in economical efficiency and can fully reduce cost can be realized.

[0070] Moreover, since each head blocks 41-44 arrange the head unit of each color to one block base 45 side, they can narrow width of face of the printing direction, and the width of face of the whole head can also do them narrowly.

[0071] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[0072] (Gestalt of the 5th operation) As shown in drawing 12, the gestalt of this operation constitutes one head block using four head units which consist of the same length, the same numbers of nozzles, and the same nozzle pitches, arranges these two head blocks and constitutes the color ink-jet head.

[0073] That is, head unit 51C which uses head unit 51M which uses head unit 51B which uses black ink, head unit 51Y which uses yellow ink, and Magenta ink, and cyano ink is arranged in order of B (black), Y (yellow), M (Magenta), and C (cyanogen) in the printing direction (the direction of the arrow A in drawing), and the direction which intersects perpendicularly, and the 1st head block 51 is constituted.

[0074] Moreover, head unit 52C which uses head unit 52M which uses head unit 52B which uses black ink, head unit 52Y which uses yellow ink, and Magenta ink, and cyan ink is arranged in the printing direction and the direction which intersects perpendicularly in order of B (black), Y (yellow), M (Magenta), and C (cyanogen), and the 2nd head block 52 is constituted.

[0075] And each aforementioned head blocks 51 and 52 were shifted a little in the printing direction and the direction which intersects perpendicularly, and are arranged in it. That is, as the portion of X5 enclosed with a circle [of drawing 12] is expanded and shown in drawing 13, as the nozzle 53 of head unit 51B which uses the black ink of the 1st head block 51, and the nozzle 54 of head unit 52B which uses the black ink of the 2nd head block 52 shifted, they arrange only one half of the nozzle pitches P in a head unit mutually.

[0076] Therefore, the relation between the nozzle of other head units 51Y, 51M, and 51C of the 1st head block 51 and the nozzle of other head units 52Y, 52M, and 52C of the 2nd head block 52 comes to shift only one half of the nozzle pitches P of a head unit mutually similarly.

[0077] If it does in this way, since the printing pixel by the 2nd head block 52 will be located between the printing pixels by the 1st head block 51, the pitch which can be printed becomes $P/2$ and printing in the resolution of the double precision of the resolution of a head block is attained. Thus, a high resolution machine can be easily realized by using two head blocks of the same composition. Moreover, if one head block is accepted and used, a low resolution machine is realizable.

[0078] Moreover, such three head blocks are used, and if the pitch between mutual nozzles shifts and arranges each head block only one third of the nozzle pitches P , the pitch which can be printed becomes $P/3$ and can raise resolution further. Namely, in order to realize the head which is n times the head block whose resolution it carries out and is one n (however, n two or more integers) use about a head block, only the nozzle P pitches $1/n$ of a head unit shift each head block, and the pitch between mutual nozzles should just arrange it.

[0079] Thus, since the head from which various kinds of resolution, such as a high resolution machine and a low resolution machine, differs only by changing the number of use of a head block with the same composition can be manufactured, the color ink-jet head which is excellent in economical efficiency and can fully reduce cost is realizable.

[0080] In addition, also in this color ink-jet head, it applies any of a multidrop formula and a volume-control formula they are, and the color ink-jet head in which gradation control is possible can be realized.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The perspective diagram having shown the important section composition of the printing section concerning the gestalt of operation of the 1st of this invention.

[Drawing 2] Drawing showing the outline composition of the color ink-jet head in the gestalt of this operation.

[Drawing 3] Drawing showing the composition of the head block in the gestalt of this operation.

[Drawing 4] Drawing for explaining the nozzle location relation between each head block in the gestalt of this operation.

[Drawing 5] Drawing showing the outline composition of the color ink-jet head in the gestalt of operation of the 2nd of this invention.

[Drawing 6] Drawing for explaining the nozzle location relation between each head block in the gestalt of this operation.

[Drawing 7] Drawing showing the outline composition of the color ink-jet head in the gestalt of operation of the 3rd of this invention.

[Drawing 8] Drawing for explaining the nozzle location relation between each head block in the gestalt of this operation.

[Drawing 9] Drawing showing the outline composition of the color ink-jet head in the gestalt of operation of the 4th of this invention.

[Drawing 10] Drawing showing the composition of the head block in the gestalt of this operation.

[Drawing 11] Drawing for explaining the nozzle location relation between each head block in the gestalt of this operation.

[Drawing 12] Drawing showing the outline composition of the color ink-jet head in the gestalt of operation of the 5th of this invention.

[Drawing 13] Drawing for explaining the nozzle location relation between each head block in the gestalt of this operation.

[Drawing 14] Drawing showing the example of 1 composition of the conventional color ink-jet head.

[Drawing 15] Drawing showing other examples of composition of the conventional color ink-jet head.

[Description of Notations]

1 — Color ink-jet head

11-14 — Head block

11B, 12B, 13B, 14B — Head unit which uses black ink

11Y, 12Y, 13Y, 14Y — Head unit which uses yellow ink

11M, 12M, 13M, 14M — Head unit which uses Magenta ink

11C, 12C, 13C, 14C — Head unit which uses cyanogen ink

16, 17, 18, 19 — Nozzle

[Translation done.]

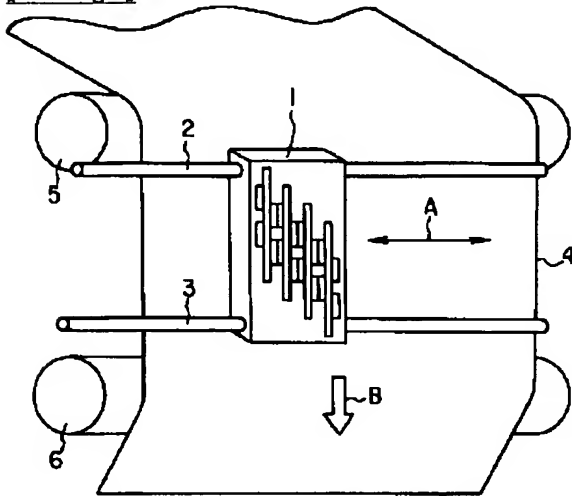
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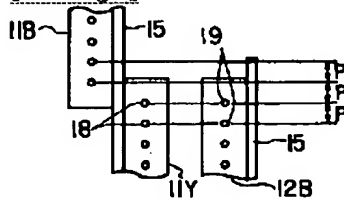
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DRAWINGS

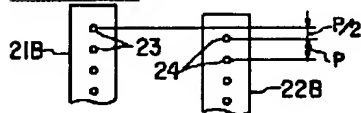
[Drawing 1]



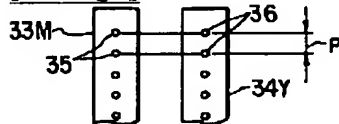
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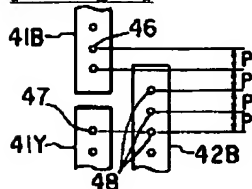
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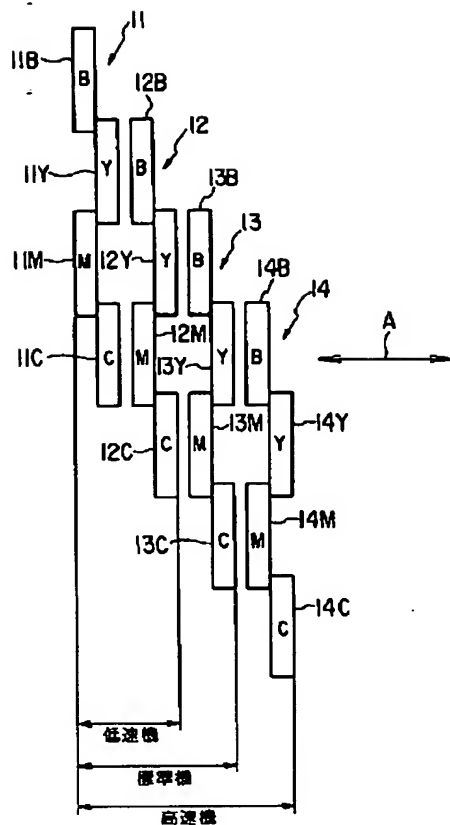
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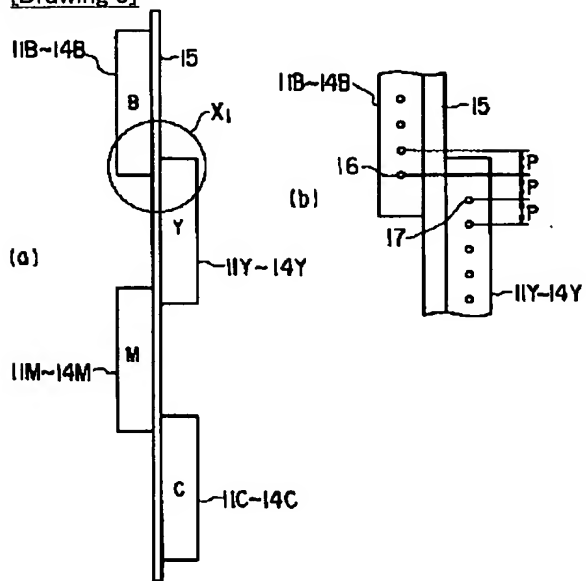
[Drawing 11]



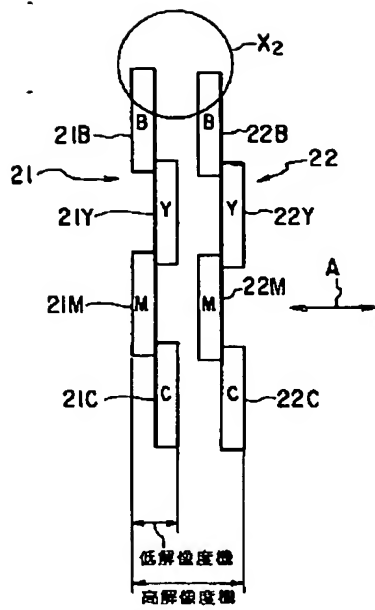
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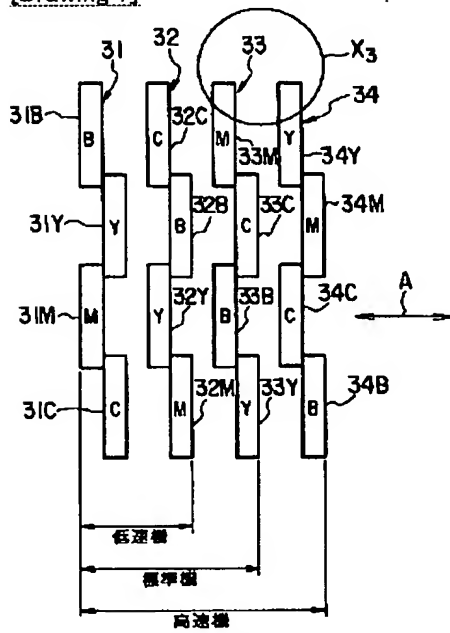
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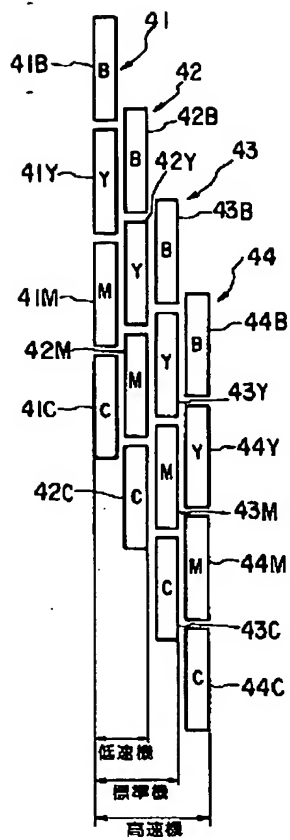
[Drawing 5]



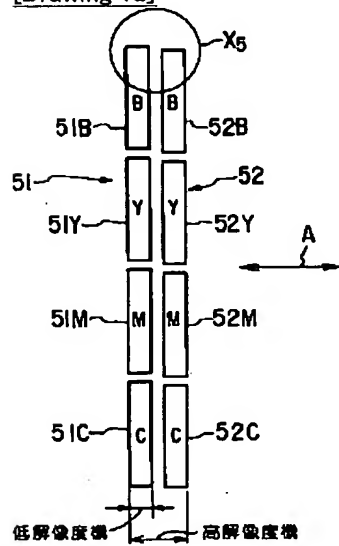
[Drawing 7]



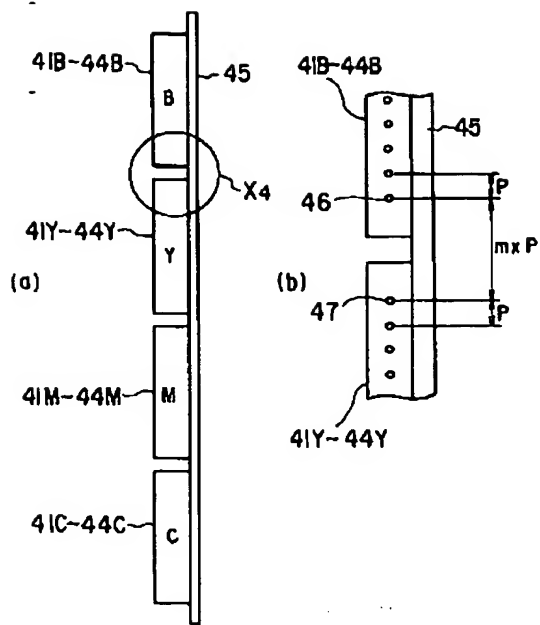
[Drawing 9]



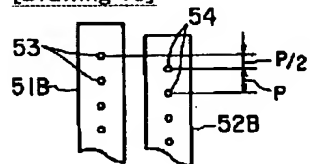
[Drawing 12]



[Drawing 10]

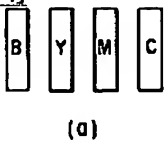


[Drawing 13]



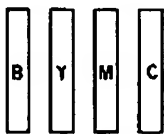
[Drawing 14]

低速機



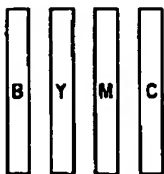
(a)

標準機



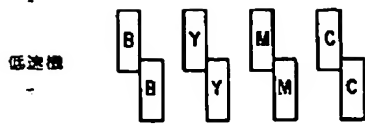
(b)

高速機

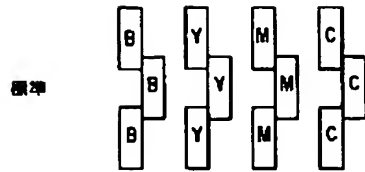


(c)

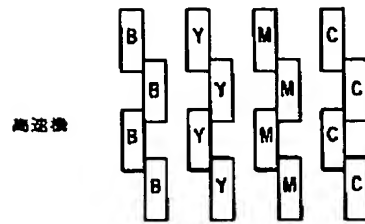
[Drawing 15]



(a)



(b)



(c)

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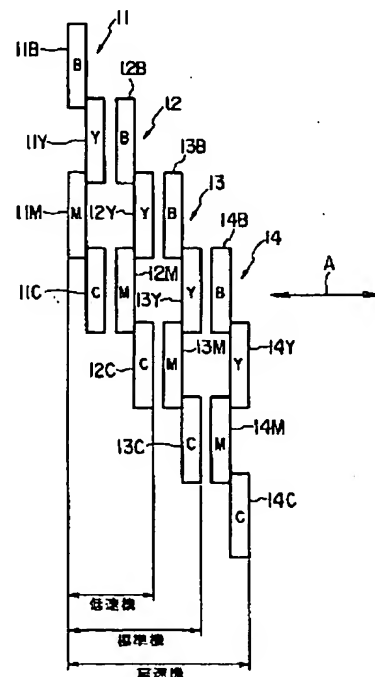
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(54) 【発明の名称】 カラーインクジェットヘッド

(57) 【要約】

【課題】 同一構成のヘッドブロックを複数個使用して高速機、標準機、低速機や高解像度機、低解像度機などを容易に実現してコストを低減する。

【解決手段】 同一の長さ、同一のノズル数、同一のノズルピッチからなるインク色の異なるヘッドユニット11B、11Y、11M、11Cを印刷方向と直交する方向に配置して1つのヘッドブロック11を構成する。そして、このヘッドブロックを4個(11~14)、印刷方向と直交する方向にヘッドユニットの長さに略相当する長さずつ順次ずらし、かつ、隣接するヘッドブロック間において端から2つ目のヘッドユニットのノズルと端のヘッドユニットのノズルが印刷する方向に一直列に並ぶように配置してカラーインクジェットヘッドを構成する。



【特許請求の範囲】

【請求項1】 それぞれのインクの色における全体のノズル数に対して、その $1/n$ （但し、 n は2以上の整数）の数のノズルを同一ピッチで設けたヘッドユニットを用い、インクの色構成をヘッドユニット単位で異ならせ、各色のヘッドユニットを印刷する方向とは直交する方向に少なくとも色数並べて1つのヘッドブロックを構成し、このヘッドブロックを印刷する方向に n 個配置したことを特徴とするカラーインクジェットヘッド。

【請求項2】 各ヘッドブロックは、各ヘッドユニットを、隣接するヘッドユニットの隣接する端のノズル間のピッチがヘッドユニットのノズルピッチと同一になるように配置したことを特徴とする請求項1記載のカラーインクジェットヘッド。

【請求項3】 各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、前記各ヘッドブロックを印刷する方向と直交する方向にヘッドユニットの長さに略相当する長さずつ順次ずらし、かつ、隣接するヘッドブロック間において端から2つ目のヘッドユニットのノズルと端のヘッドユニットのノズルが印刷する方向に一直列に並ぶように配置したことを特徴とする請求項2記載のカラーインクジェットヘッド。

【請求項4】 各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、前記各ヘッドブロックをヘッドユニットのノズルが互いにノズルピッチの $1/n$ だけずれるようにして配置したことを特徴とする請求項2記載のカラーインクジェットヘッド。

【請求項5】 各ヘッドブロックを印刷する方向にそれぞれのヘッドユニットのノズルが一直列に並ぶように配置するとともに、各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を印刷する方向に互いに同一の色が重ならないようにしたことを特徴とする請求項2記載のカラーインクジェットヘッド。

【請求項6】 各ヘッドブロックは、各ヘッドユニットを、隣接するヘッドユニットの隣接する端のノズル間のピッチがヘッドユニットのノズルピッチの整数倍になるように配置したことを特徴とする請求項1記載のカラーインクジェットヘッド。

【請求項7】 各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、前記各ヘッドブロックを印刷する方向と直交する方向にヘッドユニットの長さに略相当する長さずつ順次ずらし、かつ、隣接するヘッドブロック間において一方のヘッドブロックにおける端のヘッドユニットの他端ノズルと他方のヘッドブロックにおける端のヘッドユニットの一端ノズルとのピッチがヘッドユニットのノズルピッチと同一になるようにして配置したことを特徴とする請

求項6記載のカラーインクジェットヘッド。

【請求項8】 各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、前記各ヘッドブロックをヘッドユニットのノズルが互いにノズルピッチの $1/n$ だけずれるようにして配置したことを特徴とする請求項6記載のカラーインクジェットヘッド。

【請求項9】 それぞれのインクの色における全体のノズル数に対して、その $1/n$ （但し、 n は2以上の整数）の数のノズルを同一ピッチで設けたヘッドユニットを用い、インクの色構成をヘッドユニット単位で異ならせ、各色のヘッドユニットを印刷する方向とは直交する方向に少なくともインクの色数並べて1つのヘッドブロックを構成し、このヘッドブロックを印刷する方向に n 個配置し、前記各ノズルは複数の小さなインク液滴を順次吐出して1つの画素を形成することを特徴とするカラーインクジェットヘッド。

【請求項10】 それぞれのインクの色における全体のノズル数に対して、その $1/n$ （但し、 n は2以上の整数）の数のノズルを同一ピッチで設けたヘッドユニットを用い、インクの色構成をヘッドユニット単位で異ならせ、各色のヘッドユニットを印刷する方向とは直交する方向に少なくともインクの色数並べて1つのヘッドブロックを構成し、このヘッドブロックを印刷する方向に n 個配置し、ボリュームコントロールによって前記各ノズルから吐出するインク液滴の大きさを可変できることを特徴とするカラーインクジェットヘッド。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、プリンタ、複写機、ファクシミリ装置、プロッタ等に使用されるカラーインクジェットヘッドに関する。

【0002】

【従来の技術】インクジェット技術はカラー化の容易性からカラープリンタに広く利用されている。近年では、印刷物の高解像度化、印刷速度の高速化の要求から、インク液滴を吐出させるノズルの数が増加する傾向にある。このため、非常に多くのノズルを有する大型のインクジェットヘッドが開発されているが、歩留まりが悪く、コスト高となるため、少ないノズル数のヘッドユニットを複数組み合わせる1つのインクジェットヘッド構成する技術も開発されている。この方がコスト的に有利になるからである。例えば、少ないノズル数のヘッドユニットを複数組み合わせる1つの大きなヘッドブロックを構成し、このヘッドブロックを使用するインクの色の数だけ配置することでカラーインクジェットヘッドを構成することができ、大型のヘッドを色の数だけ配置したカラーインクジェットヘッドと同等の機能を果たすことができる。

【0003】ところで、カラーインクジェットヘッドを

使用して低速機、標準機、高速機を構成する場合、低速機ではヘッド全体のノズル数が少なくてもよいが、高速機を実現するためにはヘッド全体のノズル数を増やして一度に印刷できる画素数を多くする必要がある。

【0004】従来において、カラーインクジェットプリンタの低速機、標準機、高速機を実現する場合、図14の(a)、(b)、(c)に示すように、低速機、標準機、高速機でヘッドの長さを異ならせるもの、また、図15の(a)、(b)、(c)に示すように、低速機、標準機、高速機で配置するヘッドユニットの数、すなわち、長さの異なるヘッドブロックを使用するものが知られている。なお、図中Bはブラックインクを使用するヘッドユニットを示し、Yはイエローインクを使用するヘッドユニットを示し、Mはマゼンタインクを使用するヘッドユニットを示し、Cはシアンインクを使用するヘッドユニットを示している。

【0005】

【発明が解決しようとする課題】しかしながら、図14に示すものは、低速機、標準機、高速機で使用するヘッドの長さが異なるため、低速機、標準機、高速機でそれぞれ専用のヘッドを製造しなければならず、経済性が悪くコスト高となる問題があった。また、図15に示すものにおいても低速機、標準機、高速機でそれぞれ長さの異なるヘッドブロックを用意しなければならず、すなわち、それぞれ専用のヘッドブロックを製造しなければならず、やはり経済性が悪くコスト高となる問題があった。

【0006】このことは、低速機、標準機、高速機を問わず、使用するヘッド数を2倍に増やし、一方のヘッドのノズルピッチ間に他方のヘッドのノズルを位置させて解像度を2倍にするような場合でも低速機、標準機、高速機でそれぞれ専用のヘッドやヘッドブロックを増やすことになり、やはり経済性が悪くコスト高となる問題があった。そこで、本発明は、同一構成のヘッドブロックを複数個使用して高速機、標準機、低速機や高解像度機、低解像度機などを容易に実現でき、経済性に優れコストを十分に低減できるカラーインクジェットヘッドを提供する。

【0007】

【課題を解決するための手段】請求項1記載の発明は、それぞれのインクの色における全体のノズル数に対して、その $1/n$ （但し、 n は2以上の整数）の数のノズルを同一ピッチで設けたヘッドユニットを用い、インクの色構成をヘッドユニット単位で異ならせ、各色のヘッドユニットを印刷する方向とは直交する方向に少なくとも色数並べて1つのヘッドブロックを構成し、このヘッドブロックを印刷する方向に n 個配置したカラーインクジェットヘッドにある。

【0008】請求項2記載の発明は、請求項1記載のカラーインクジェットヘッドにおいて、各ヘッドブロック

は、各ヘッドユニットを、隣接するヘッドユニットの隣接する端のノズル間のピッチがヘッドユニットのノズルピッチと同一になるように配置したことにある。

【0009】請求項3記載の発明は、請求項2記載のカラーインクジェットヘッドにおいて、各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、各ヘッドブロックを印刷する方向と直交する方向にヘッドユニットの長さに略相当する長さずつ順次ずらし、かつ、隣接するヘッドブロック間において端から2つ目のヘッドユニットのノズルと端のヘッドユニットのノズルが印刷する方向に一直列に並ぶように配置したことにある。

【0010】請求項4記載の発明は、請求項2記載のカラーインクジェットヘッドにおいて、各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、各ヘッドブロックをヘッドユニットのノズルが互いにノズルピッチの $1/n$ だけずれるようにして配置したことにある。

【0011】請求項5記載の発明は、請求項2記載のカラーインクジェットヘッドにおいて、各ヘッドブロックを印刷する方向にそれぞれのヘッドユニットのノズルが一直列に並ぶように配置するとともに、各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を印刷する方向に互いに同一の色が重ならないようにしたことにある。

【0012】請求項6記載の発明は、請求項1記載のカラーインクジェットヘッドにおいて、各ヘッドブロックは、各ヘッドユニットを、隣接するヘッドユニットの隣接する端のノズル間のピッチがヘッドユニットのノズルピッチの整数倍になるように配置したことにある。

【0013】請求項7記載の発明は、請求項6記載のカラーインクジェットヘッドにおいて、各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、各ヘッドブロックを印刷する方向と直交する方向にヘッドユニットの長さに略相当する長さずつ順次ずらし、かつ、隣接するヘッドブロック間において一方のヘッドブロックにおける端のヘッドユニットの他端ノズルと他方のヘッドブロックにおける端のヘッドユニットの一端ノズルとのピッチがヘッドユニットのノズルピッチと同一になるようにして配置したことにある。

【0014】請求項8記載の発明は、請求項6記載のカラーインクジェットヘッドにおいて、各ヘッドブロックにおけるそれぞれのインクの色構成に対応するヘッドユニットの配置を同一とし、各ヘッドブロックをヘッドユニットのノズルが互いにノズルピッチの $1/n$ だけずれるようにして配置したことにある。

【0015】請求項9記載の発明は、それぞれのインクの色における全体のノズル数に対して、その $1/n$ （但し、 n は2以上の整数）の数のノズルを同一ピッチで設

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けたヘッドユニットを用い、インクの色構成をヘッドユニット単位で異ならせ、各色のヘッドユニットを印刷する方向とは直交する方向に少なくともインクの色数並べて1つのヘッドブロックを構成し、このヘッドブロックを印刷する方向にn個配置し、各ノズルは複数の小さなインク液滴を順次吐出して1つの画素を形成するカラーインクジェットヘッドにある。

【0016】請求項10記載の発明は、それぞれのインクの色における全体のノズル数に対して、その1/n (但し、nは2以上の整数)の数のノズルを同一ピッチで設けたヘッドユニットを用い、インクの色構成をヘッドユニット単位で異ならせ、各色のヘッドユニットを印刷する方向とは直交する方向に少なくともインクの色数並べて1つのヘッドブロックを構成し、このヘッドブロックを印刷する方向にn個配置し、ボリュウムコントロールによって各ノズルから吐出するインク液滴の大きさを可変できるカラーインクジェットヘッドにある。

【0017】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照して説明する。

(第1の実施の形態) 図1は印刷部の要部構成を示した斜視図で、1は本願発明を構成するカラーインクジェットヘッドである。このカラーインクジェットヘッド1は2本の平行なスライド軸2、3に摺動自在に設けられている。すなわち、前記カラーインクジェットヘッド1は各スライド軸2、3により図中矢印Aで示すように左右に移動して印刷するようになっている。4は記録紙等の記録媒体で、この記録媒体4は搬送ローラ5、6によって図中矢印Bで示すように下方向に搬送されるようになっている。

【0018】前記カラーインクジェットヘッド1は各スライド軸2、3に沿って左右に移動しながら前記記録媒体4に印刷を行い、1往復すると前記記録媒体4が所定の距離だけ搬送し、再びカラーインクジェットヘッド1が左右に移動して前回の印刷部分に連続した位置に印刷を行い、これを繰り返すことで記録媒体4に対して所望の印刷を行うことになる。

【0019】図2は前記カラーインクジェットヘッド1の構成を概略的に示した図で、このヘッド1は、同一の長さ、同一のノズル数、同一のノズルピッチからなるインク色の異なるヘッドユニットを4個使用して1つのヘッドブロックを構成し、このヘッドブロックを4個配置して構成している。

【0020】すなわち、ブラックインクを使用するヘッドユニット11B、イエローインクを使用するヘッドユニット11Y、マゼンタインクを使用するヘッドユニット11M、シアンインクを使用するヘッドユニット11Cを、印刷方向(図中矢印Aで示す方向)と直交する方向に、B(ブラック)、Y(イエロー)、M(マゼンタ)、C(シアン)の順に並べて第1のヘッドブロック

11を構成している。

【0021】また、ブラックインクを使用するヘッドユニット12B、イエローインクを使用するヘッドユニット12Y、マゼンタインクを使用するヘッドユニット12M、シアンインクを使用するヘッドユニット12Cを、印刷方向と直交する方向に、B(ブラック)、Y(イエロー)、M(マゼンタ)、C(シアン)の順に並べて第2のヘッドブロック12を構成している。

【0022】また、ブラックインクを使用するヘッドユニット13B、イエローインクを使用するヘッドユニット13Y、マゼンタインクを使用するヘッドユニット13M、シアンインクを使用するヘッドユニット13Cを、印刷方向と直交する方向に、B(ブラック)、Y(イエロー)、M(マゼンタ)、C(シアン)の順に並べて第3のヘッドブロック13を構成している。

【0023】また、ブラックインクを使用するヘッドユニット14B、イエローインクを使用するヘッドユニット14Y、マゼンタインクを使用するヘッドユニット14M、シアンインクを使用するヘッドユニット14Cを、印刷方向と直交する方向に、B(ブラック)、Y(イエロー)、M(マゼンタ)、C(シアン)の順に並べて第4のヘッドブロック14を構成している。

【0024】前記各ヘッドブロック11、12、13、14は、図3の(a)に示すように、ブロックベース15の一方の側にブラックインクを使用するヘッドユニット11B~14Bとマゼンタインクを使用するヘッドユニット11M~14Mを配置するとともに他方の側にイエローインクを使用するヘッドユニット11Y~14Yとシアンインクを使用するヘッドユニット11C~14Cを配置し、かつ、これら各ヘッドユニットが印刷方向と直交する方向に、B(ブラック)、Y(イエロー)、M(マゼンタ)、C(シアン)の順に並ぶようにしている。

【0025】そして、図3の(b)に図3の(a)の丸で囲んだX₁の部分拡大して示すように、ブラックインクを使用するヘッドユニット11B~14Bの他端のノズル16とイエローインクを使用するヘッドユニット11Y~14Yの一端のノズル17とのピッチが各ヘッドユニット11B~14B、11Y~14YにおけるノズルピッチPと等しくなるように、ヘッドユニット11B~14Bの他端部とヘッドユニット11Y~14Yの一端部とが若干重なるようにして配置している。

【0026】これは、イエローインクを使用するヘッドユニット11Y~14Yの他端のノズルとマゼンタインクを使用するヘッドユニット11M~14Mの一端のノズル、並びにマゼンタインクを使用するヘッドユニット11M~14Mの他端のノズルとシアンインクを使用するヘッドユニット11C~14Cの一端のノズルとの関係についても同様である。

【0027】そして、前記各ヘッドブロック11~14

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を印刷方向と直交する方向にヘッドユニットの長さに略相当する長さずつ順次ずらし、かつ、隣接するヘッドブロック間において端から2つ目のヘッドユニットのノズルと端のヘッドユニットのノズルが印刷する方向に一直列に並ぶように配置している。

【0028】すなわち、図4に示すように、前記第1のヘッドブロック11の端から2つ目のヘッドユニットであるイエローインクを使用するヘッドユニット11Yのノズル18と前記第2のヘッドブロック12の端のヘッドユニットであるブラックインクを使用するヘッドユニット12Bのノズル19が印刷する方向に一直列に並ぶように配置している。

【0029】また、同様に、前記第2のヘッドブロック12の端から2つ目のヘッドユニットであるイエローインクを使用するヘッドユニット12Yのノズルと前記第3のヘッドブロック13の端のヘッドユニットであるブラックインクを使用するヘッドユニット13Bのノズルが印刷する方向に一直列に並ぶように配置し、前記第3のヘッドブロック13の端から2つ目のヘッドユニットであるイエローインクを使用するヘッドユニット13Yのノズルと前記第4のヘッドブロック14の端のヘッドユニットであるブラックインクを使用するヘッドユニット14Bのノズルが印刷する方向に一直列に並ぶように配置している。

【0030】なお、各ヘッドユニットのノズル数は、設備の面、歩留まりの面、プリンタ仕様としてもっとも少ない数、あるいはプリンタ仕様としてもっとも多い数の整数分の1などを考慮して決定すればよい。

【0031】このような構成のカラーインクジェットヘッド1を使用すれば、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の各色のヘッドユニットが印刷する方向にそれぞれ離れていても印刷する方向と直交する方向に4個配置され、しかも各ノズルがすべてピッチPの間隔で配列されることになるので、それぞれの色において各ヘッドユニットのノズルからのインク吐出タイミングを制御すればヘッド1が1往復動作することでヘッドユニットの略4個分に相当する幅で印刷が行なわれることになり、高速機が実現できる。

【0032】また、同一構成のヘッドブロックを使用しているもので、例えば、ヘッドブロックを1個減らして3個とすれば、この場合にはヘッドが1往復動作することでヘッドユニットの略3個分に相当する幅で印刷が行なわれることになり、標準機が実現できる。さらに、ヘッドブロックを1個減らして2個とすれば、この場合にはヘッドが1往復動作することでヘッドユニットの略2個分に相当する幅で印刷が行なわれることになり、低速機が実現できる。

【0033】このように、構成が同一のヘッドブロックの使用数を異ならせるのみで高速機、標準機、低速機のヘッドが製造できるので、高速機、標準機、低速機に合

わせて専用のヘッドブロックを製造する必要はなく、経済性に優れコストを十分に低減できるカラーインクジェットヘッドが実現できる。

【0034】ところで、カラーインクジェットヘッドにおいてノズルから吐出するインク量を変える場合がある。例えば、ポスター等を印刷する大判のプリンタの場合、印刷物は通常離れて見ることになるので、インクの滲みや裏面までインクが染み込むようなことがあっても濃い濃度で印刷する場合が多い。一方、オフィス等で使用されるプリンタは、文字など近くで見ることになるのでインクの滲みは無い方がよい。また、両面印刷することもあるので用紙の裏面へのインクの染み込みも無い方が望ましい。

【0035】このように、印刷する目的によってノズルから吐出するインク量に全く異なる要求が行われ、これらの要求に対して用紙などの記録媒体で対応することもできるが、充分に対処するには吐出するインク量を変える必要がある。このため、使用する目的によって例えばノズル径の異なるヘッドを使用する場合があるが、しかし、これではノズル径の異なる各種のヘッドを製造しなければならないということになる。

【0036】そこで、階調制御のできるヘッドを使用すれば同一のノズルから1画素印刷のために吐出するインクの量を可変できるので各種の濃度に対応できることになる。階調制御のできるインクジェットヘッドには、ノズルから複数の小さなインク液滴を順次吐出して1つの画素（ドット）を形成し、このとき吐出するインク液滴の数を制御して階調表現するマルチドロップ式のインクジェットヘッドと、印加電圧や通電時間を変えてインク室の圧力を制御してノズルから吐出するインク液滴の大きさそのものを制御するボリュームコントロール式のインクジェットヘッドがある。

【0037】前述したカラーインクジェットヘッド1は、各ヘッドブロックの各ヘッドユニットに対してこの両方式の何れも適用することができ、これにより、階調制御が可能なカラーインクジェットヘッドを使用した高速機、標準機、低速機のそれぞれのプリンタが容易に実現できることになる。

【0038】（第2の実施の形態）この実施の形態は、図5に示すように、同一の長さ、同一のノズル数、同一のノズルピッチからなるヘッドユニットを4個使用して1つのヘッドブロックを構成し、このヘッドブロックを2個配置してカラーインクジェットヘッドを構成している。

【0039】すなわち、ブラックインクを使用するヘッドユニット21B、イエローインクを使用するヘッドユニット21Y、マゼンタインクを使用するヘッドユニット21M、シアンインクを使用するヘッドユニット21Cを、印刷方向（図中矢印Aの方向）と直交する方向に、B（ブラック）、Y（イエロー）、M（マゼン

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タ)、C(シアン)の順に並べて第1のヘッドブロック21を構成している。

【0040】また、ブラックインクを使用するヘッドユニット22B、イエローインクを使用するヘッドユニット22Y、マゼンタインクを使用するヘッドユニット22M、シアンインクを使用するヘッドユニット22Cを、印刷方向と直交する方向に、B(ブラック)、Y(イエロー)、M(マゼンタ)、C(シアン)の順に並べて第2のヘッドブロック22を構成している。

【0041】そして、前記各ヘッドブロック21、2210を印刷方向と直交する方向に若干ずらして配置している。すなわち、図6に図5の丸で囲んだ X_2 の部分を拡大して示すように、第1のヘッドブロック21のブラックインクを使用するヘッドユニット21Bのノズル23と第2のヘッドブロック22のブラックインクを使用するヘッドユニット22Bのノズル24が互いにヘッドユニットにおけるノズルピッチPの1/2だけずれるようにして配置している。

【0042】従って、第1のヘッドブロック21の他のヘッドユニット21Y、21M、21Cのノズルと第220のヘッドブロック22の他のヘッドユニット22Y、22M、22Cのノズルとの関係も同様に互いにヘッドユニットのノズルピッチPの1/2だけずれるようになる。

【0043】このようにすれば、第1のヘッドブロック21による印刷画素の間に第2のヘッドブロック22による印刷画素が位置することになるので印刷可能なピッチは $P/2$ となり、ヘッドブロックの解像度の2倍の解像度での印刷が可能になる。このように、同一構成のヘッドブロックを2個使用することで高解像度機が容易に実現できる。また、ヘッドブロックを1個のみ使用すれば低解像度機が実現できる。

【0044】また、このようなヘッドブロックを3個使用し、各ヘッドブロックを互いのノズル間のピッチがノズルピッチPの1/3だけずらして配置すれば印刷可能なピッチは $P/3$ となり、さらに解像度を高めることができる。すなわち、ヘッドブロックをn(但し、nは2以上の整数)使用して解像度が1つのヘッドブロックのn倍のヘッドを実現するには、各ヘッドブロックを互いのノズル間のピッチがヘッドユニットのノズルピッチP40の1/nだけずらして配置すればよい。

【0045】このように、構成が同一のヘッドブロックの使用数を異ならせるのみで高解像度機や低解像度機など各種の解像度の異なるヘッドが製造できるので、経済性に優れコストを十分に低減できるカラーインクジェットヘッドが実現できる。

【0046】なお、このカラーインクジェットヘッドにおいても、マルチドロップ式及びボリュームコントロール式の何れかを適用して階調制御が可能なカラーインクジェットヘッドを実現できる。

【0047】(第3の実施の形態) この実施の形態は、図7に示すように、同一の長さ、同一のノズル数、同一のノズルピッチからなるインク色の異なるヘッドユニットを4個使用して1つのヘッドブロックを構成し、このヘッドブロックを印刷方向にヘッドユニットのインク色が互いに重ならないようにして4個配置してカラーインクジェットヘッドを構成している。

【0048】すなわち、ブラックインクを使用するヘッドユニット31B、イエローインクを使用するヘッドユニット31Y、マゼンタインクを使用するヘッドユニット31M、シアンインクを使用するヘッドユニット31Cを、印刷方向(図中矢印Aの方向)と直交する方向に、B(ブラック)、Y(イエロー)、M(マゼンタ)、C(シアン)の順に並べて第1のヘッドブロック31を構成している。

【0049】また、ブラックインクを使用するヘッドユニット32B、イエローインクを使用するヘッドユニット32Y、マゼンタインクを使用するヘッドユニット32M、シアンインクを使用するヘッドユニット32Cを、印刷方向と直交する方向に、C(シアン)、B(ブラック)、Y(イエロー)、M(マゼンタ)の順に並べて第2のヘッドブロック32を構成している。

【0050】また、ブラックインクを使用するヘッドユニット33B、イエローインクを使用するヘッドユニット33Y、マゼンタインクを使用するヘッドユニット33M、シアンインクを使用するヘッドユニット33Cを、印刷方向と直交する方向に、M(マゼンタ)、C(シアン)、B(ブラック)、Y(イエロー)の順に並べて第3のヘッドブロック33を構成している。

【0051】また、ブラックインクを使用するヘッドユニット34B、イエローインクを使用するヘッドユニット34Y、マゼンタインクを使用するヘッドユニット34M、シアンインクを使用するヘッドユニット34Cを、印刷方向と直交する方向に、Y(イエロー)、M(マゼンタ)、C(シアン)、B(ブラック)の順に並べて第4のヘッドブロック34を構成している。

【0052】前記各ヘッドブロック31~34における各ヘッドユニットの配置関係及びノズルのピッチ関係は前述した図3の場合と同様である。そして、前記各ヘッドブロック31~34を印刷方向にそれぞれのヘッドユニットが一行に並ぶようにして配置している。すなわち、図8に図7の丸で囲んだ X_3 の部分を拡大して示すように、第3のヘッドブロック33のマゼンタインクを使用するヘッドユニット33Mのノズル35と第4のヘッドブロック34のイエローインクを使用するヘッドユニット34Yのノズル36が印刷方向に一行に並ぶように配置している。同様に第1のヘッドブロック31のブラックインクを使用するヘッドユニット31Bのノズル及び第2のヘッドブロック32のシアンインクを使用するヘッドユニット32Cのノズルも第3のヘッドブロッ

ク 33 のマゼンタインクを使用するヘッドユニット 33 M のノズル 35 と印刷方向に一直列に並ぶように配置している。

【0053】このような構成のカラーインクジェットヘッドを使用すれば、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の各色のヘッドユニットが印刷する方向にそれぞれ離れていても印刷する方向と直交する方向に 4 個配置され、しかも各ノズルがすべてピッチ P の間隔で配列されることになるので、それぞれの色において各ヘッドユニットのノズルからのインク吐出タイミングを制御すればヘッドが 1 往復動作することでヘッドユニットの略 4 個分に相当する幅で印刷が行なわれることになり、高速機が実現できる。

【0054】また、同一構成のヘッドブロックを使用しているので、例えば、ヘッドブロックを 1 個減らして 3 個とすれば、この場合にはヘッドが 1 往復動作することでヘッドユニットの略 3 個分に相当する幅で印刷が行なわれることになり、標準機が実現できる。さらに、ヘッドブロックを 1 個減らして 2 個とすれば、この場合にはヘッドが 1 往復動作することでヘッドユニットの略 2 個分に相当する幅で印刷が行なわれることになり、低速機が実現できる。

【0055】このように、構成が同一で使用するインクの色配列のみが異なるヘッドブロックの使用数を異ならせるのみで高速機、標準機、低速機のヘッドが製造できるので、高速機、標準機、低速機に合わせて専用のヘッドブロックを製造する必要はなく、経済性に優れたコストを十分に低減できるカラーインクジェットヘッドが実現できる。また、各ヘッドブロックを印刷方向と直交する方向にずらさずに印刷方向に一直列に並べて配置している

ので、ヘッド全体の長さを略ヘッドブロックの長さにでき短くできる。

【0056】なお、このカラーインクジェットヘッドにおいても、マルチドロップ式及びボリュームコントロール式の何れかを適用して階調制御が可能なカラーインクジェットヘッドを実現できる。

【0057】（第 4 の実施の形態）この実施の形態は、図 9 に示すように、同一の長さ、同一のノズル数、同一

のノズルピッチからなるインク色の異なるヘッドユニットを 4 個使用して 1 つのヘッドブロックを構成し、このヘッドブロックを 4 個配置して構成している。

【0058】すなわち、ブラックインクを使用するヘッド

ユニット 41 B、イエローインクを使用するヘッドユ

ニット 42 B、イエローインクを使用するヘッドユニット 42 Y、マゼンタインクを使用するヘッドユニット 42 M、シアンインクを使用するヘッドユニット 42 C を、印刷方向と直交する方向に所定の間隔を開けて、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の順に並べて第 2 のヘッドブロック 42 を構成している。

【0060】また、ブラックインクを使用するヘッドユニット 43 B、イエローインクを使用するヘッドユニット 43 Y、マゼンタインクを使用するヘッドユニット 43 M、シアンインクを使用するヘッドユニット 43 C を、印刷方向と直交する方向に所定の間隔を開けて、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の順に並べて第 3 のヘッドブロック 43 を構成している。

【0061】また、ブラックインクを使用するヘッドユニット 44 B、イエローインクを使用するヘッドユニット 44 Y、マゼンタインクを使用するヘッドユニット 44 M、シアンインクを使用するヘッドユニット 44 C を、印刷方向と直交する方向に所定の間隔を開けて、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の順に並べて第 4 のヘッドブロック 44 を構成している。

【0062】前記各ヘッドブロック 41、42、43、44 は、図 10 の (a) に示すように、ブロックベース 45 の一方の側にブラックインクを使用するヘッドユニット 41 B ~ 44 B、イエローインクを使用するヘッドユニット 41 Y ~ 44 Y、マゼンタインクを使用するヘッドユニット 41 M ~ 44 M、シアンインクを使用するヘッドユニット 41 C ~ 44 C を配置し、かつ、これら各ヘッドユニットが印刷方向と直交する方向に、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の順に並ぶようにしている。

【0063】そして、図 10 の (b) に図 10 の (a) の丸で囲んだ X₄ の部分を拡大して示すように、ブラックインクを使用するヘッドユニット 41 B ~ 44 B の他端のノズル 46 とイエローインクを使用するヘッドユニット 41 Y ~ 44 Y の一端のノズル 47 とのピッチが各ヘッドユニット 41 B ~ 44 B、41 Y ~ 44 Y におけるノズルピッチ P の整数倍、すなわち、m 倍となるように、ヘッドユニット 41 B ~ 44 B の他端部とヘッドユニット 41 Y ~ 44 Y の一端部とが所定の間隔を開けて配置している。

【0064】これは、イエローインクを使用するヘッドユニット 41 Y ~ 44 Y の他端のノズルとマゼンタインクを使用するヘッドユニット 41 M ~ 44 M の一端のノズル、並びにマゼンタインクを使用するヘッドユニット 41 M ~ 44 M の他端のノズルとシアンインクを使用するヘッドユニット 41 C ~ 44 C の一端のノズルとの関係についても同様である。

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【0065】そして、前記各ヘッドブロック41~44を印刷方向と直交する方向にヘッドユニットの長さよりも短い長さずつ順次ずらして配置している。例えば、図11に示すように、前記第1のヘッドブロック41の他端のヘッドユニットであるブラックインクを使用するヘッドユニット41Bの他端のノズル46と次のイエローインクを使用するヘッドユニット41Yの一端のノズル47との間に、前記第2のヘッドブロック42の他端のヘッドユニットであるブラックインクを使用するヘッドユニット42Bの一端側のノズル48が丁度2個入り、しかも、ノズル46とノズル48、ノズル48とノズル47のピッチが丁度ヘッドユニットのノズルピッチPと一致するようにして第2のヘッドブロック42を配置している。

【0066】この配置は、前記第2のヘッドブロック42に対する第3のヘッドブロック43の配置及び第3のヘッドブロック43に対する第4のヘッドブロック44の配置についても同様である。

【0067】このような構成のカラーインクジェットヘッド1を使用すれば、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の各色のヘッドユニットが印刷する方向にそれぞれ離れていても印刷する方向と直交する方向に4個配置され、しかも各ノズルがすべてピッチPの間隔で配列されることになるので、それぞれの色において各ヘッドユニットのノズルからのインク吐出タイミングを制御すればヘッド1が1往復動作することでヘッドユニットの略4個分に相当する幅で印刷が行なわれることになり、高速機が実現できる。

【0068】また、同一構成のヘッドブロックを使用しているので、例えば、ヘッドブロックを1個減らして3個とすれば、この場合にはヘッドが1往復動作することでヘッドユニットの略3個分に相当する幅で印刷が行なわれることになり、標準機が実現できる。さらに、ヘッドブロックを1個減らして2個とすれば、この場合にはヘッドが1往復動作することでヘッドユニットの略2個分に相当する幅で印刷が行なわれることになり、低速機が実現できる。

【0069】このように、構成が同一のヘッドブロックの使用数を異ならせるのみで高速機、標準機、低速機のヘッドが製造できるので、高速機、標準機、低速機に合わせて専用のヘッドブロックを製造する必要はなく、経済性に優れコストを十分に低減できるカラーインクジェットヘッドが実現できる。

【0070】また、各ヘッドブロック41~44はブロックベース45の一方の側に各色のヘッドユニットを配置しているので、印字方向の幅を狭くでき、ヘッド全体の幅も狭くできる。

【0071】なお、このカラーインクジェットヘッドにおいても、マルチドロップ式及びボリュームコントロール式の何れかを適用して階調制御が可能なカラーインク

ジェットヘッドを実現できる。

【0072】（第5の実施の形態）この実施の形態は、図12に示すように、同一の長さ、同一のノズル数、同一のノズルピッチからなるヘッドユニットを4個使用して1つのヘッドブロックを構成し、このヘッドブロックを2個配置してカラーインクジェットヘッドを構成している。

【0073】すなわち、ブラックインクを使用するヘッドユニット51B、イエローインクを使用するヘッドユニット51Y、マゼンタインクを使用するヘッドユニット51M、シアンインクを使用するヘッドユニット51Cを、印刷方向（図中矢印Aの方向）と直交する方向に、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の順に並べて第1のヘッドブロック51を構成している。

【0074】また、ブラックインクを使用するヘッドユニット52B、イエローインクを使用するヘッドユニット52Y、マゼンタインクを使用するヘッドユニット52M、シアンインクを使用するヘッドユニット52Cを、印刷方向と直交する方向に、B（ブラック）、Y（イエロー）、M（マゼンタ）、C（シアン）の順に並べて第2のヘッドブロック52を構成している。

【0075】そして、前記各ヘッドブロック51、52を印刷方向と直交する方向に若干ずらして配置している。すなわち、図13に図12の丸で囲んだX5の部分を拡大して示すように、第1のヘッドブロック51のブラックインクを使用するヘッドユニット51Bのノズル53と第2のヘッドブロック52のブラックインクを使用するヘッドユニット52Bのノズル54が互いにヘッドユニットにおけるノズルピッチPの1/2だけずれるようにして配置している。

【0076】従って、第1のヘッドブロック51の他のヘッドユニット51Y、51M、51Cのノズルと第2のヘッドブロック52の他のヘッドユニット52Y、52M、52Cのノズルとの関係も同様に互いにヘッドユニットのノズルピッチPの1/2だけずれるようになる。

【0077】このようにすれば、第1のヘッドブロック51による印刷画素の間に第2のヘッドブロック52による印刷画素が位置することになるので印刷可能なピッチはP/2となり、ヘッドブロックの解像度の2倍の解像度での印刷が可能になる。このように、同一構成のヘッドブロックを2個使用することで高解像度機が容易に実現できる。また、ヘッドブロックを1個のみ使用すれば低解像度機が実現できる。

【0078】また、このようなヘッドブロックを3個使用し、各ヘッドブロックを互いのノズル間のピッチがノズルピッチPの1/3だけずらして配置すれば印刷可能なピッチはP/3となり、さらに解像度を高めることができる。すなわち、ヘッドブロックをn（但し、nは2

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以上の整数) 使用して解像度が1つのヘッドブロックのn倍のヘッドを実現するには、各ヘッドブロックを互いのノズル間のピッチがヘッドユニットのノズルピッチPの1/nだけずらして配置すればよい。

【0079】このように、構成が同一のヘッドブロックの使用数を異ならせるのみで高解像度機や低解像度機など各種の解像度の異なるヘッドが製造できるので、経済性に優れコストを十分に低減できるカラーインクジェットヘッドが実現できる。

【0080】なお、このカラーインクジェットヘッドにおいて、マルチドロップ式及びボリュームコントロール式の何れかを適用して階調制御が可能なカラーインクジェットヘッドを実現できる。

【0081】

【発明の効果】各請求項記載の発明によれば、同一構成のヘッドブロックを複数個使用して高速機、標準機、低速機や高解像度機、低解像度機などを容易に実現でき、経済性に優れコストを十分に低減できる。

【図面の簡単な説明】

【図1】本発明の第1の実施の形態に係る印刷部の要部構成を示した斜視図。

【図2】同実施の形態におけるカラーインクジェットヘッドの概略構成を示す図。

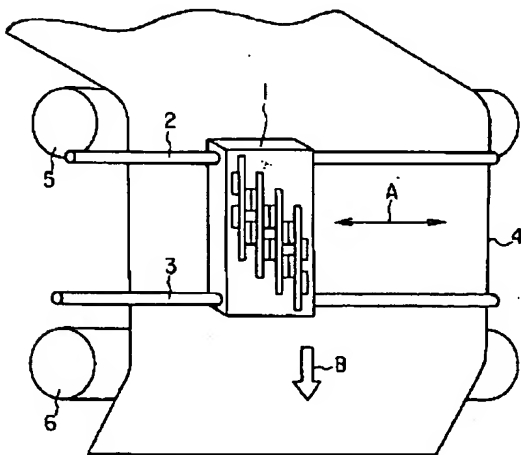
【図3】同実施の形態におけるヘッドブロックの構成を示す図。

【図4】同実施の形態における各ヘッドブロック間のノズル位置関係を説明するための図。

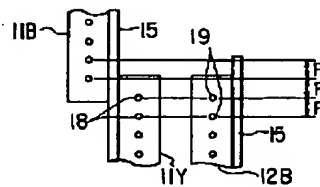
【図5】本発明の第2の実施の形態におけるカラーインクジェットヘッドの概略構成を示す図。

【図6】同実施の形態における各ヘッドブロック間のノズル位置関係を説明するための図。

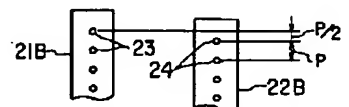
【図1】



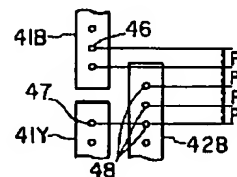
【図4】



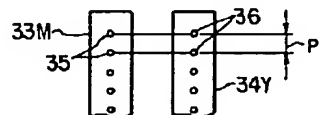
【図6】



【図11】



【図8】



【図7】本発明の第3の実施の形態におけるカラーインクジェットヘッドの概略構成を示す図。

【図8】同実施の形態における各ヘッドブロック間のノズル位置関係を説明するための図。

【図9】本発明の第4の実施の形態におけるカラーインクジェットヘッドの概略構成を示す図。

【図10】同実施の形態におけるヘッドブロックの構成を示す図。

【図11】同実施の形態における各ヘッドブロック間のノズル位置関係を説明するための図。

【図12】本発明の第5の実施の形態におけるカラーインクジェットヘッドの概略構成を示す図。

【図13】同実施の形態における各ヘッドブロック間のノズル位置関係を説明するための図。

【図14】従来のカラーインクジェットヘッドの一構成例を示す図。

【図15】従来のカラーインクジェットヘッドの他の構成例を示す図。

【符号の説明】

1…カラーインクジェットヘッド

11～14…ヘッドブロック

11B, 12B, 13B, 14B…ブラックインクを使用するヘッドユニット

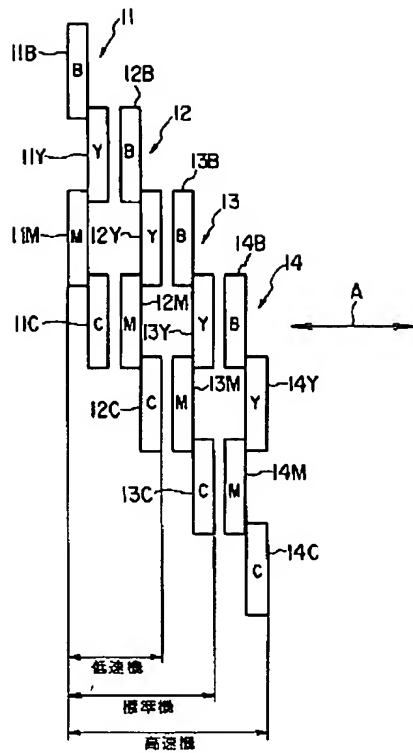
11Y, 12Y, 13Y, 14Y…イエローインクを使用するヘッドユニット

11M, 12M, 13M, 14M…マゼンタインクを使用するヘッドユニット

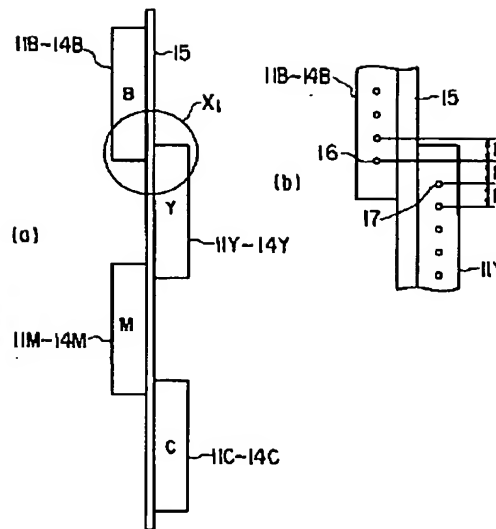
11C, 12C, 13C, 14C…シアンインクを使用するヘッドユニット

16, 17, 18, 19…ノズル

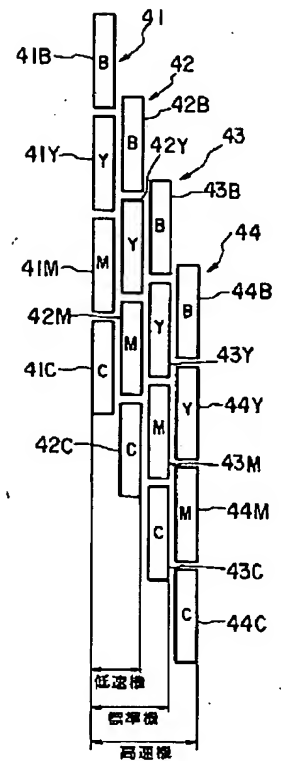
【図 2】



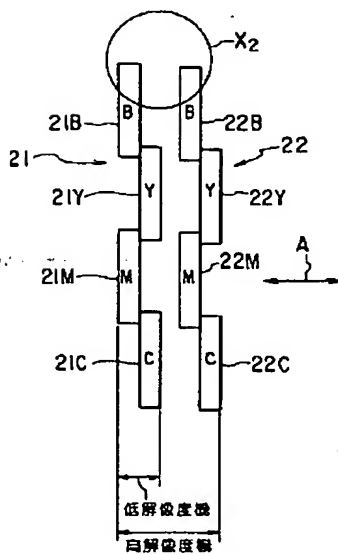
【図 3】



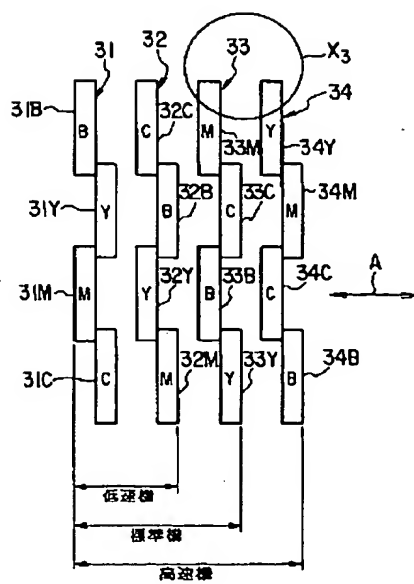
【図 9】



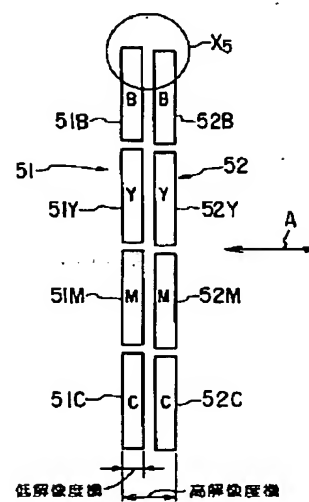
【図 5】



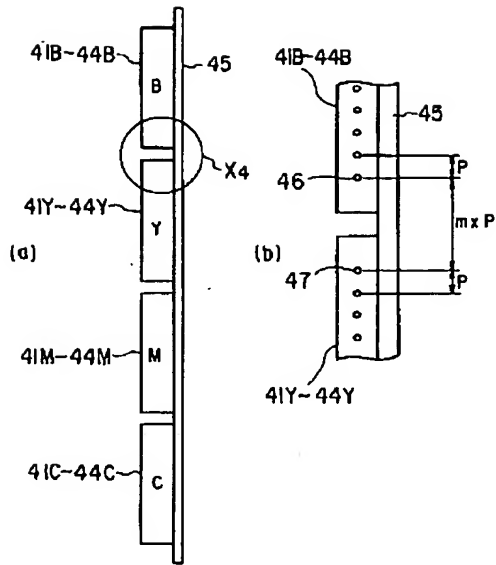
【図 7】



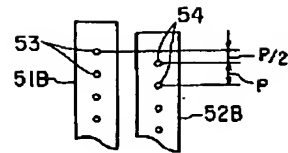
【図 12】



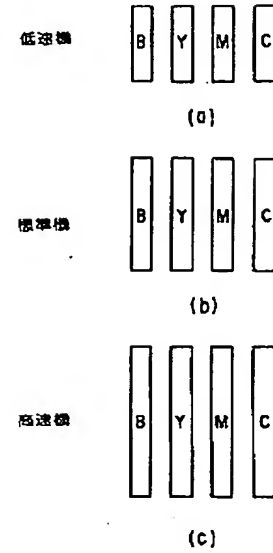
【図10】



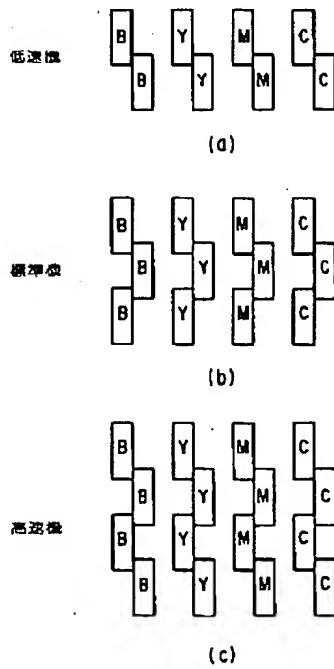
【図13】



【図14】



【図15】



フロントページの続き

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